

4.0 INDUSTRY DESCRIPTION

As discussed in Section 3.0, the MP&M Point Source Category covers sites that perform manufacturing, rebuilding, or maintenance activities while processing metal parts, machinery, or metal products. The category includes 18 industrial sectors: aerospace, aircraft, bus and truck, electronic equipment, hardware, household equipment, instruments, job shops, miscellaneous metal products, mobile industrial equipment, motor vehicle, office machines, ordnance, precious metals and jewelry, printed wiring boards, railroad, ships and boats, and stationary industrial equipment.

This section describes the MP&M industry. Section 4.1 presents an overview of the industry; Section 4.2 provides a general discussion of unit operations performed, metal types processed, and volumes of wastewater discharged; Section 4.3 discusses trends in the industry; and Section 4.4 lists the references used for Section 4.

4.1 Overview of the Industry

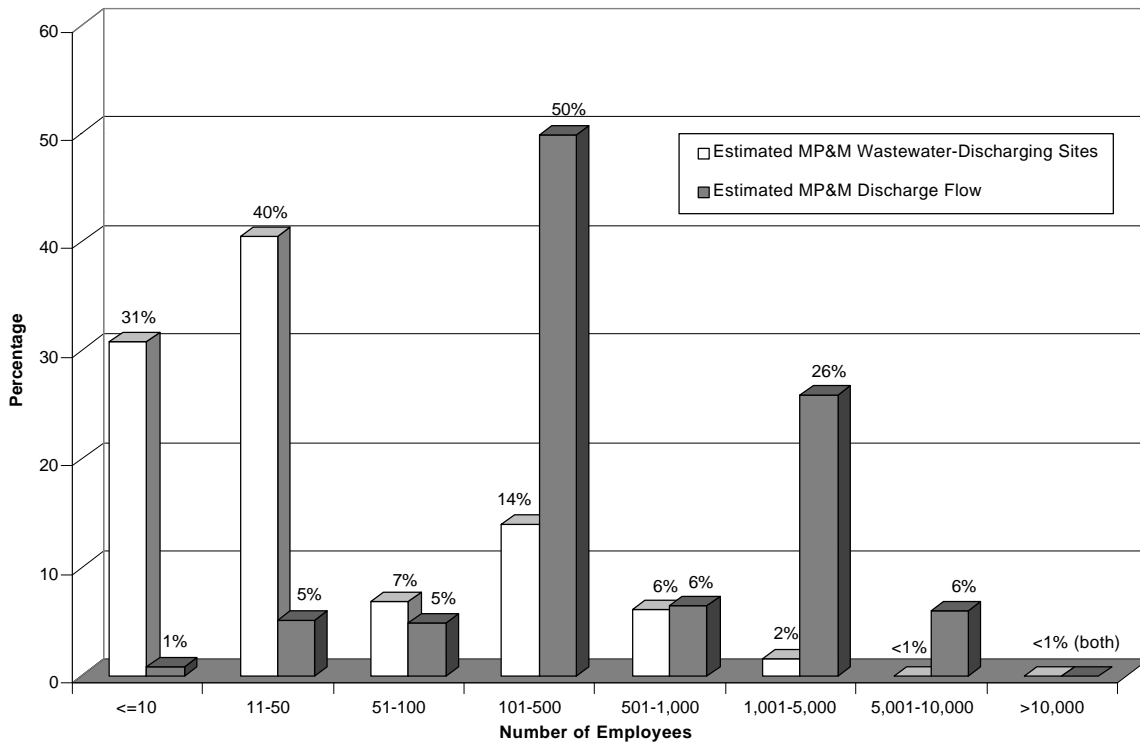
This section discusses the MP&M industry, including the number and size of MP&M sites, the geographic distribution of these sites, the number of wastewater discharging sites, and the number of non-wastewater-discharging sites.

4.1.1 Number and Size of MP&M Sites

Based on the MP&M survey database, there are approximately 89,000 MP&M sites in the United States. Based on detailed survey results, approximately 63,000 MP&M sites discharge process wastewater. The remaining 26,000 sites fall into one of three categories: zero dischargers, non-water-users, or contract haulers.

MP&M wastewater-discharging sites range in size from sites with less than 10 employees to sites with tens of thousands of employees, and with wastewater discharge flow rates of less than 100 gallons per year to more than 100 million gallons per year. The following figure summarizes the estimated number of wastewater-discharging MP&M sites by number of employees and estimated total discharge flow. This shows that approximately 92 percent of MP&M sites have 500 or fewer employees and approximately 78 percent have 100 or fewer employees.

As shown in Figure 4-1 the number of employees at a site does not necessarily correspond with the discharge flow at the site. [This is demonstrated by the fact that sites with greater than 500 employees account for only 38 percent of the total industry flow.] Section 4.1.3 presents additional information on the estimated number of MP&M sites by discharge flow range.



Source: MP&M Survey Database.

Note: There are 62,749 wastewater-discharging MP&M sites. Total MP&M wastewater flow is 122 billion gallons per year.

Figure 4-1. MP&M Wastewater-Discharging Sites by Number of Employees and Estimated Total Discharge Flow

4.1.2 Geographic Distribution

MP&M wastewater-discharging facilities are located throughout the United States. EPA received survey data from all 10 EPA regions and from 48 states. MP&M facilities are mostly concentrated in industrialized areas, with the highest concentration of facilities in California, Pennsylvania, and Illinois. The following map shows the estimated number of MP&M facilities located in each EPA region.

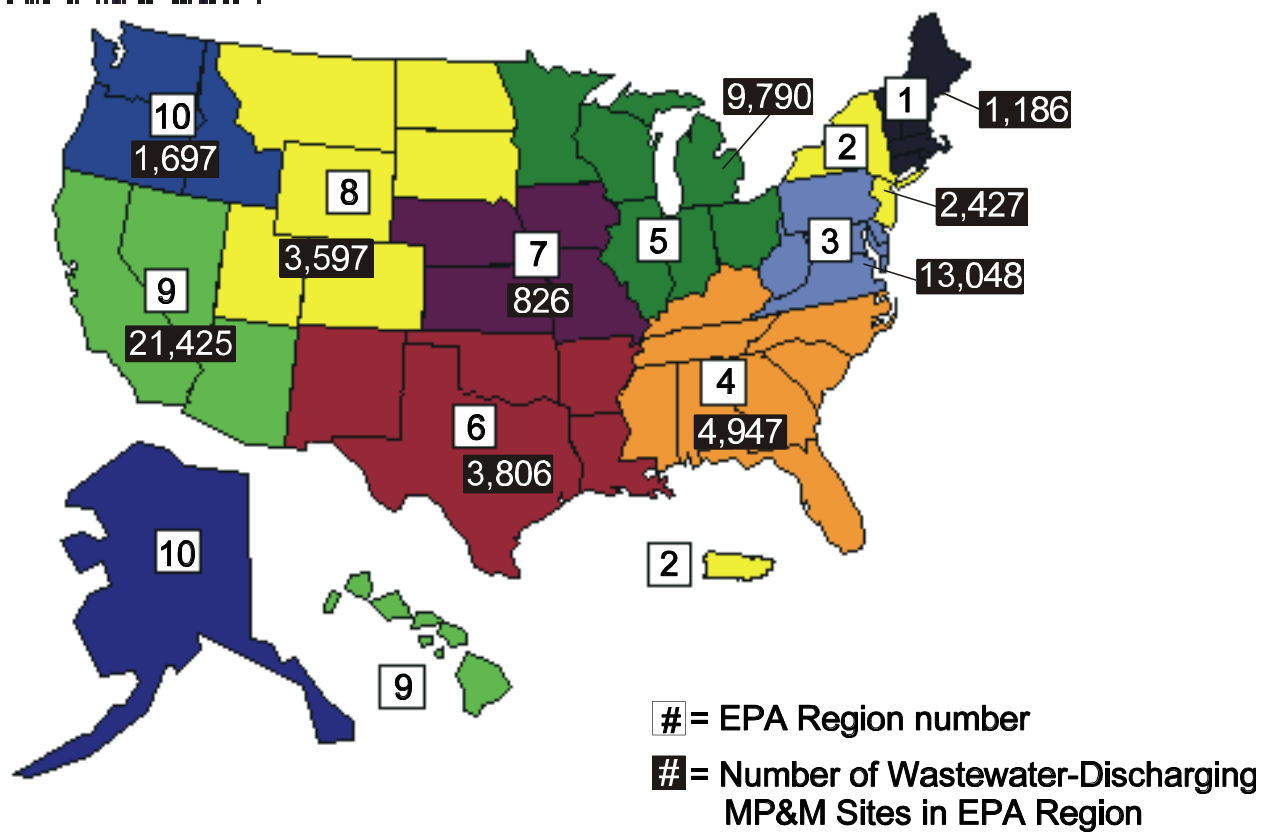


Figure 4-2. Estimated Number of MP&M Facilities by EPA Region

4.1.3 Wastewater-Discharging Sites

The MP&M category includes 18 industrial sectors. Table 4-1 summarizes the number of MP&M wastewater-discharging sites by sector. Because some sites perform operations in more than one sector, the sum of wastewater-discharging sites by sector exceeds the total number of wastewater-discharging sites identified in the survey. As indicated in Table 4-1, the railroad sector has the smallest number of wastewater-discharging sites (97) and the job shops sector has the largest number of wastewater-discharging sites (33,683).

Table 4-1**MP&M Wastewater-Discharging Sites by Sector**

Sector	Estimated Number of Sites That Discharge Process Waste Water^a
Aerospace	312
Aircraft	1,356
Bus and Truck	1,861
Electronic Equipment	2,289
Hardware	6,275
Household Equipment	2,003
Instruments	3,208
Iron and Steel ^c	153
Job Shop ^b	33,683
Miscellaneous Metal Products	3,030
Mobile Industrial Equipment	879
Motor Vehicle	1,506
Municipality ^c	4,342
Office Machine	249
Ordnance	403
Precious Metals and Jewelry	307
Printed Circuit Boards	617
Railroad	97
Ships and Boats	273
<u>Stationary Industrial Equipment</u>	<u>6,217</u>

Source: MP&M Survey Database.

^a Because some sites perform operations in more than one sector, the sum of sites by sector exceeds the total number of sites that discharge water (62,749).

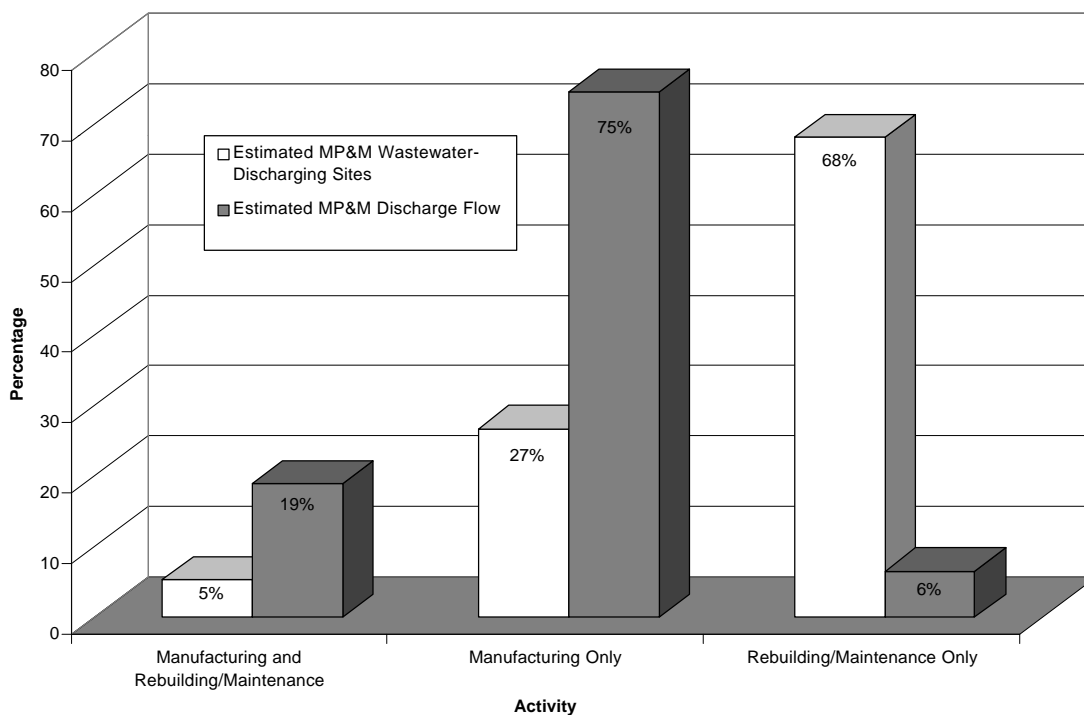
^b The Job Shop Sector includes any MP&M facility that owns < 50% of the products they work on (annual area basis). This includes metal finishing job shops, but also may include other job shops such as painting or assembly job shops.

^c Technical surveys for these sites did not include sector information therefore they were listed separately for this table.

In addition to description by sector, MP&M operations can also be described by two types of activities: manufacturing and rebuilding/maintenance. For the purpose of the MP&M regulation, EPA defines these activities below:

- C Manufacturing is the series of unit operations necessary to produce metal products, and is generally performed in a production environment.
- C Rebuilding/maintenance is the series of unit operations necessary to disassemble used metal products into components, replace the components or subassemblies or restore them to original function, and

reassemble the metal products. These operations are intended to keep metal products in operating condition and can be performed in either a production or a non-production environment.



Source: MP&M Survey Database.

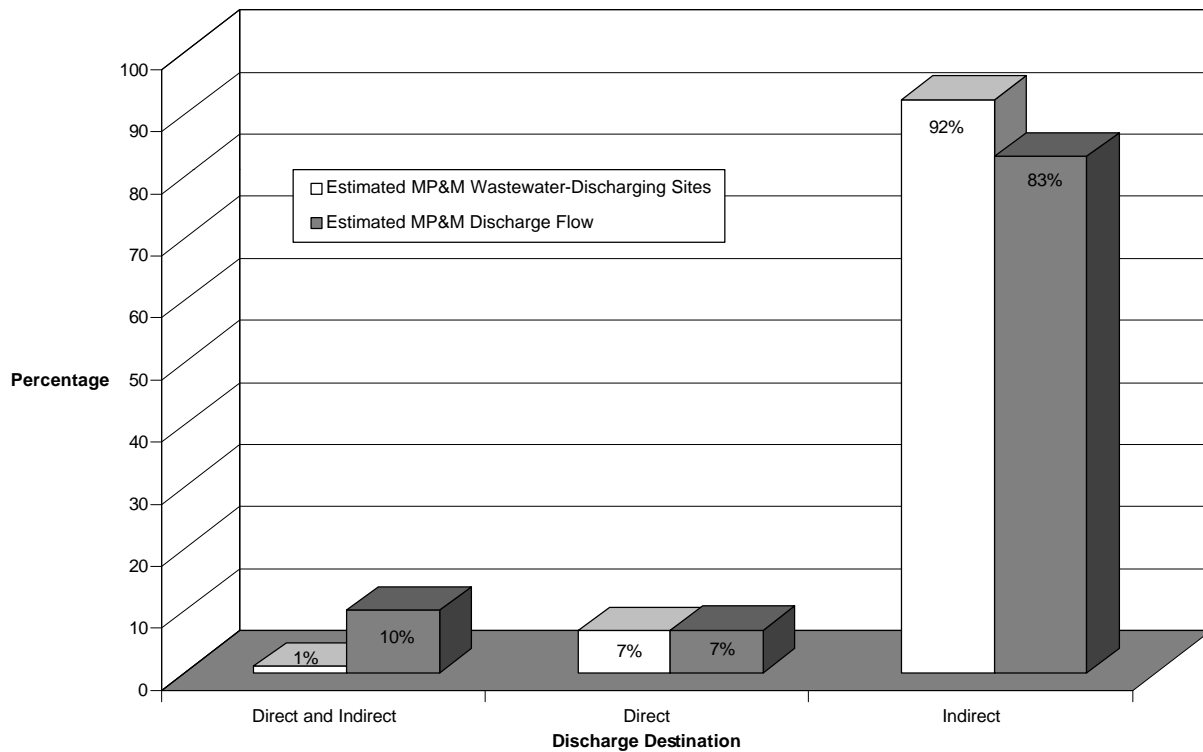
Note: There are 62,749 wastewater-discharging MP&M sites. Total wastewater flow is 122 billion gallons per year.

Figure 4-3. MP&M Wastewater-Discharging Sites and Total Discharge Flow by Activity

Figure 4-3 summarizes the estimated number of MP&M wastewater-discharging sites and baseline (i.e., current) total discharge flow by activity. The largest number of sites (42,733) perform rebuilding/maintenance only and account for the smallest amount (6 percent) of the total estimated discharge flow for the industry. The smallest number of sites (3,239) perform both manufacturing and rebuilding/maintenance activities but represent 19 percent of the total estimated discharge flow for the industry.

MP&M sites include direct dischargers, indirect dischargers, and those that are both direct and indirect dischargers. A direct discharger is a site that discharges wastewater to a surface water (e.g., river, lake, ocean). An indirect discharger is a site that discharges wastewater to a publicly owned treatment works (POTW). For the purposes of the MP&M regulation, EPA considers sites discharging exclusively to privately owned treatment works to be zero dischargers

that contract haul their wastewater to centralized waste treatment facilities. Figure 4-4 summarizes the number of MP&M wastewater-discharging sites and baseline total discharge flow by discharge status. This figure shows that the majority of MP&M discharging facilities are indirect dischargers.

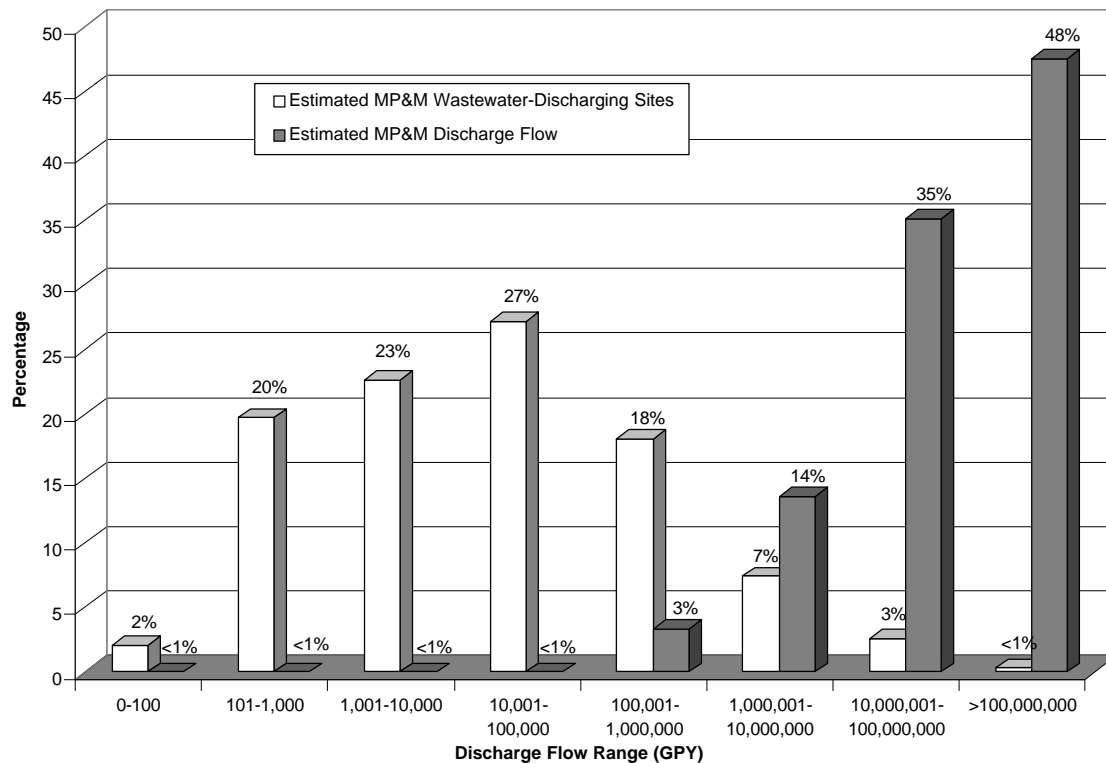


Source: MP&M Survey Database.

Note: There are 62,749 wastewater-discharging MP&M sites. Total MP&M wastewater flow is 122 billion gallons per year.

Figure 4-4. MP&M Wastewater-Discharging Sites and Total Discharge Flow by Discharge Status

Wastewater discharge flows from MP&M sites range from less than 100 gallons per year to greater than 100 million gallons per year. Figure 4-5 summarizes the wastewater discharge flow ranges for MP&M sites. As this figure shows, sites discharging more than one million gallons per year (approximately 10 percent of the total sites) account for approximately 97 percent of the total wastewater discharge from the industry. In contrast, sites discharging less than 100,000 gallons per year (approximately 72% of the total sites) account for less than 1% of the overall wastewater discharge flow for the industry.



Source: MP&M Survey Database.

Note: There are 62,749 wastewater-discharging MP&M sites. Total MP&M wastewater flow is 122 billion gallons per year.

Figure 4-5. MP&M Wastewater-Discharging Sites by Total Discharge Flow

4.1.4 Non-Wastewater-Discharging Sites

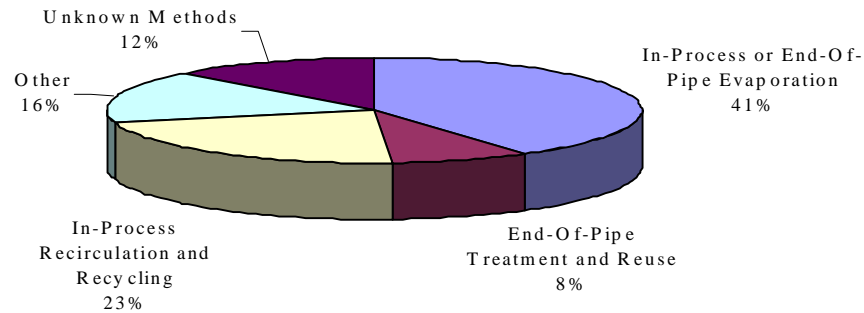
Based on the results of the survey, approximately 26,000 MP&M sites do not use process water (dry sites) or use but do not discharge process water. Based on information from the MP&M detailed surveys, site visits, and technical literature, these sites achieve zero discharge of process wastewater in one of the following ways:

- Ⓒ Contract haul all process wastewater generated on site;
- Ⓒ Discharge process wastewater to either on-site septic systems or deep-well injection systems;
- Ⓒ Perform end-of-pipe treatment and reuse all process wastewater generated on site;

- C Perform either in-process or end-of-pipe evaporation to eliminate wastewater discharges; or
- C Perform in-process recirculation and recycling to eliminate wastewater discharges.

As discussed in Section 3.0, EPA mailed surveys to 50 statistically selected sites that were using but not discharging process water. Based on those survey responses, five of these sites contract hauled all wastewater generated on site, eight actually discharged process wastewater, 18 had no process wastewater discharges, and 19 were not engaged in MP&M. EPA mailed an additional 24 surveys, selected for technical reasons, to sites which reported not discharging process water on their screener questionnaire. Of these, 14 actually discharged process wastewater, two had no process wastewater discharges, and eight were not engaged in MP&M activities.

In addition to the 20 sites discussed above that do not discharge process wastewater, 205 of the 1996 screener survey respondents reported eliminating wastewater discharge by in-process or end-of-pipe evaporation, end-of-pipe treatment and reuse, in-process recirculation and recycling, or other unspecified means. Figure 4-6 shows the number of sites using each type of zero discharge method. Note that Figure 4-6 provides actual number of survey respondents and not national estimates. EPA discusses the methods used by the 225 sites that have eliminated wastewater discharges below.



Note: There are 225 survey sites which have eliminated wastewater discharge.

Figure 4-6. Number of Screener Survey Respondents Utilizing Each Zero Discharge Method

In-Process or End-Of-Pipe Evaporation. Ninety-one screener survey respondents reported discharging wastewater to either evaporators, on-site ponds, or lagoons for evaporation of process wastewater. These sites typically performed less than 20 wastewater-discharging unit operations. None of these sites reported recovering the process wastewater. Sludge from the evaporation units was reported as being contract hauled for off-site disposal.

End-Of-Pipe Treatment and Reuse. Nineteen screener survey respondents reported eliminating wastewater discharge through end-of-pipe treatment and reuse of all wastewater generated on site. These sites typically performed less than 13 wastewater-discharging unit operations on site. As discussed in Sections 9.0 and 14.0, EPA considered end-of-pipe ion exchange with reuse of all wastewater generated in developing the MP&M effluent guidelines, but determined that the technology was not appropriate for national effluent guidelines for this industry because its effectiveness and potential metals recovery advantages were generally limited to specific sites and specific metal types and not to the industry as a whole.

In-Process Recirculation and Recycling. Fifty screener survey respondents reported eliminating wastewater discharge through in-process recirculation and recycling. Most of these sites perform fewer than 10 wastewater-generating unit operations; five sites perform between 10 and 20 wastewater-generating unit operations. Several sites perform heat treating operations, in which a stagnant water quench is used and not discharged. Some sites perform surface finishing operations (e.g., alkaline cleaning and chemical conversion coating) in stagnant baths and do not discharge wastewater. Make-up water is added for evaporation. Based on the data from MP&M sites, only sites with few unit operations are typically able to achieve zero discharge solely through in-process recirculation and recycling.

Other. Thirty-seven screener survey respondents reported eliminating wastewater discharge through a variety of other methods including land application and septic systems.

EPA's Underground Injection Control (UIC) Program, authorized by the Safe Drinking Water Act, regulates shallow on-site systems and deep wells that discharge fluids or wastewater into the subsurface and thus may endanger underground sources of drinking water. If a facility disposes any wastewater (other than solely sanitary waste) into a shallow disposal system (e.g., septic system or a floor drain connected to a dry well) that well is covered by the UIC program. If you think you have a UIC disposal well on your facility, you should contact your State UIC Program authority to determine your compliance status.

EPA published the Class V Rule in the Federal Register on December 7, 1999 (64 FR 68545), which affected facilities using on-site systems to dispose waste associated with motor vehicle service and repair in state-designated groundwater protection areas. The EPA is scheduled to develop additional requirements for other Class V wells that receive endangering waste. Contact your State UIC Program for more information on these developing regulations.

4.2 General Discussion of MP&M Processes

This section presents a general discussion of MP&M processes, including the different categories of unit operations, descriptions of the unit operations performed, metal types processed, and wastewater discharge volumes generated.

4.2.1 Types of Unit Operations Performed

MP&M sites perform a wide variety of process unit operations on metal parts, products, and machines. The MP&M regulatory development effort initially focused on 45 unit operations (and their associated rinses) performed at MP&M sites, plus wet air pollution control operations. EPA describes these 46 unit operations in detail in Section 4.2.2. During the regulatory development effort, EPA identified additional unit operations performed at MP&M sites. Section 4.2.2 also lists these additional unit operations.

Each of the MP&M unit operations can be listed under one of the following types:

- C Metal shaping operations;
- C Surface preparation operations;
- C Metal deposition operations;
- C Organic deposition operations;
- C Surface finishing operations;
- C Assembly operations;
- C Drydock operations;
- C Specialized printed wiring board operations; and
- C Unit operations performed at Steel Forming and Finishing sites.

Metal shaping operations are mechanical operations that alter the form of raw materials into intermediate and final products. Surface preparation operations are chemical and mechanical operations that remove unwanted materials from or alter the chemical or physical properties of the surface prior to subsequent MP&M operations. Metal deposition operations apply a metal coating to the part surface by chemical or physical means. Organic deposition operations apply an organic material to the part by chemical or physical means. Sites may perform metal and organic deposition operations to protect the surface from wear or corrosion, modify the electrical properties of the surface, or alter the appearance of the surface. Surface finishing operations protect and seal the surface of the treated part from wear or corrosion by chemical means. Sites may use some surface finishing operations to alter the appearance of the part surface. Assembly operations are performed throughout the manufacturing, rebuilding, or maintenance process. Drydock operations are those MP&M unit operations performed at ship and boat facilities within drydocks or similar structures and incorporate many of the previously described types of MP&M operations. Specialized printed wiring board operations are those specific to the manufacture or rebuilding/maintenance of wiring boards (such as Carbon Black Deposition, Solder Flux Cleaning, and Photo Image Developing). Additional unit operations performed at Steel Forming and Finishing sites are defined in Section 14.1.5. Table 4-2 lists example MP&M unit operations common to each type of operation described above.

Table 4-2**MP&M Unit Operations Listed by Type**

Type of Unit Operation	Example Unit Operations Performed
Metal Shaping	Machining, Grinding, Deformation
Surface Preparation	Alkaline Cleaning, Acid Treatment
Metal Deposition	Electroplating, Vapor Deposition
Organic Deposition	Painting
Surface Finishing	Chemical Conversion Coating
Assembly	Testing (e.g. leak testing), Assembly
Specialized Printed Wiring Board	Solder Leveling, Photo Resist Applications
Unit operations performed at Steel Forming and Finishing sites	Mechanical Descaling, Hot Dip Coating

At a given MP&M site, the specific unit operations performed and the sequence of operations depend on many factors, including the activity (i.e., manufacturing, rebuilding/maintenance), industrial sector, and type of product processed. As a result, MP&M sites perform many different combinations and sequences of unit operations. For example, MP&M sites that repair, rebuild or maintain products often conduct preliminary operations that may not be performed at manufacturing facilities (e.g. disassembly, cleaning, or degreasing to remove dirt and oil accumulated during use of the product). In general, however, MP&M products are processed in the following order:

- C The raw material (e.g., bar stock, wire, rod, sheet stock, plates) undergoes some type of metal shaping process, such as impact or pressure deformation, machining, or grinding. In these operations, the raw material is shaped into intermediate forms for further processing or into final forms for assembly and shipment to the customer. Sites typically clean and degrease the parts between some of the shaping operations to remove lubricants, coolants, and metal fines. Sites may also perform heat treating operations between shaping operations to alter the physical characteristics of the part.
- C After shaping, the part typically undergoes some type of surface preparation operation, such as alkaline cleaning, acid pickling, or barrel finishing. The specific operation used depends on the subsequent unit operations to be performed and the final use of the products. For example, prior to electroplating, parts typically undergo acid pickling (i.e., acid cleaning) to prepare the surface of the part for electroplating. Before assembly, parts typically undergo alkaline cleaning or barrel finishing.

Parts undergo surface preparation operations at various stages of the production process. Additional cleaning and degreasing steps precede metal deposition, organic deposition, surface finishing, and assembly operations.

- C Metal and organic deposition operations typically follow shaping and surface preparation operations, and precede surface finishing and final assembly operations. Electroplating operations typically follow alkaline and acid treatment operations, while painting operations typically follow phosphate conversion coating and alkaline treatment operations.
- C Surface finishing operations are typically performed after shaping and surface preparation operations. Some surface finishing operations are performed after metal deposition operations. For example, chromate conversion coating typically follows acid cleaning, although this operation is sometimes performed as a sealant operation after electroplating (e.g. chemical conversion coating of cadmium plated parts). Some surface finishing operations are also performed prior to organic coating operations. For example, phosphate conversion coating frequently precedes painting to enhance the paint adhesion.
- C Disassembly operations may be performed as the first step in the rebuilding process. Assembly operations, on the other hand, are performed at many steps of the manufacturing and rebuilding process. Assembly operations prepare the final product. Assembly may also involve some final shaping (e.g., drilling and grinding) and surface preparation (e.g., alkaline cleaning). Final assembly operations are generally the last operations performed prior to shipment to the customer.

Some MP&M sites conduct all of these types of operations in manufacturing or rebuilding products, while others may perform only some types. For example, a site in the hardware sector may start with bar stock and manufacture a final hardware product, performing machining, cleaning, electroplating, conversion coating, painting, degreasing, and assembly operations. Another hardware site may focus on painting the parts, and only perform cleaning and painting operations. A third hardware site may only shape the parts, and perform only machining, cleaning, and degreasing operations.

4.2.2 MP&M Unit Operations and Rinses

This section describes each of the 46 MP&M unit operations listed in Table 4-3 and the wastewater generated from each operation and associated rinse. The following descriptions are included for informational purposes and are not meant to supersede regulatory definitions (e.g., definitions for unit operations that are part of the proposed rule are defined in Section 14 in the applicable subcategory section).

Table 4-3**Typical Unit Operations Performed at MP&M Sites**

Unit Operation Name	
1. Abrasive Blasting	24. Electroplating without Chromium or Cyanide
2. Abrasive Jet Machining	25. Electropolishing
3. Acid Treatment with Chromium	26. Floor Cleaning
4. Acid Treatment without Chromium	27. Grinding
5. Alkaline Cleaning for Oil Removal	28. Heat Treating
6. Alkaline Treatment with Cyanide	29. Impact Deformation
7. Alkaline Treatment without Cyanide	30. Machining
8. Anodizing with Chromium	31. Metal Spraying
9. Anodizing without Chromium	32. Painting - Spray or Brush
10. Aqueous Degreasing	33. Painting - Immersion
11. Assembly/Disassembly	34. Plasma Arc Machining
12. Barrel Finishing	35. Polishing
13. Burnishing	36. Pressure Deformation
14. Chemical Conversion Coating without Chromium	37. Salt Bath Descaling
15. Chemical Milling	38. Soldering/Brazing
16. Chromate Conversion Coating	39. Solvent Degreasing
17. Corrosion Preventive Coating	40. Stripping (paint)
18. Electrical Discharge Machining	41. Stripping (metallic coating)
19. Electrochemical Machining	42. Testing
20. Electroless Plating	43. Thermal Cutting
21. Electrolytic Cleaning	44. Washing Finished Products
22. Electroplating with Chromium	45. Welding
23. Electroplating with Cyanide	46. Wet Air Pollution Control

Source: MP&M Survey database.

- 1 **Abrasive Blasting** involves removing surface films from a workpiece by using abrasive directed at high velocity against the workpiece. Abrasive blasting includes bead, grit, shot, and sand blasting, and may be performed either dry or with water. The primary applications of wet abrasive blasting include: removing burrs on precision parts; producing satin or matte finishes; removing fine tool marks; and removing light mill scale, surface oxide, or welding scale. Wet blasting can be used to finish fragile items such as electronic components. Also, some aluminum parts are wet blasted to achieve a fine-grained matte finish for decorative purposes. With abrasive blasting operations, the water and abrasive are typically reused until the particle size diminishes due to impacting and fracture.
- 2 **Abrasive Jet Machining** includes removing stock material from a workpiece by a high-speed stream of abrasive particles carried by a liquid or gas from a nozzle. Abrasive jet machining is used for deburring, drilling, and cutting thin sections of metal or composite material. Unlike abrasive blasting, this process operates at

pressures of thousands of pounds per square inch. The liquid streams are typically alkaline or emulsified oil solutions, although water can also be used.

- 3 **Acid Treatment With Chromium** is a general term used to describe any application of an acid solution containing chromium to a metal surface. Acid cleaning, chemical etching, and pickling are types of acid treatment.

Chromic acid is used occasionally for cleaning cast iron, stainless steel, cadmium and aluminum, and bright dipping of copper and copper alloys. Also, chromic acid solutions can be used as final steps in acid cleaning phosphate conversion coating systems.

For chemical conversion coatings formulated with chromic acid, see unit operation 16.

Wastewater generated from acid treatment includes spent solutions and rinse waters. Spent solutions are typically batch discharged and treated or disposed of off site. Most acid treatment operations are followed by a water rinse to remove residual acid.

- 4 **Acid Treatment Without Chromium** is a general term used to describe any application of an acid solution, not containing chromium, to a metal surface. Acid cleaning, chemical etching, and pickling are types of acid treatment.

Wastewater generated from acid treatment includes spent solutions and rinse waters. Spent solutions are typically batch discharged and treated or disposed of off site. Most acid treatment operations are followed by a water rinse to remove residual acid.

- 5 **Alkaline Cleaning for Oil Removal** is a general term for the application of an alkaline cleaning agent to a metal part to remove oil and grease during the manufacture, maintenance, or rebuilding of a metal product.

This unit operation does not include the washing of finished products after routine use (see unit operation 44), or the application of an alkaline cleaning agent to remove nonoily contaminants such as dirt and scale (see unit operations 6 and 7). Wastewater generated from this operation includes spent cleaning solutions and rinse waters.

- C **Alkaline cleaning** is performed to remove foreign contaminants from parts. This process is commonly applied prior to finishing operations, such as electroplating.

C Emulsion cleaning is an alkaline treatment (typically performed in the pH range of 7 to 9) that uses either complex chemical enzymes or common organic solvents (e.g., kerosene, mineral oil, glycols, and benzene) dispersed in water with the aid of an emulsifying agent. Depending on the solvent used, cleaning is performed at temperatures from room temperature to 82EC (180EF). The process is often used as a replacement for vapor degreasing.

6 **Alkaline Treatment With Cyanide** is a general term used to describe the application of an alkaline solution containing cyanide to a metal surface to clean it.

Wastewater generated from alkaline treatment includes spent solutions and rinse waters. Alkaline treatment solutions become contaminated during use from the introduction of soils and/or dissolution of the base metal, and they are typically batch discharged for treatment or disposal. Alkaline treatment operations are typically followed by a water rinse that is discharged to treatment. EPA does not consider the washing of finished products after routine use to be part of this unit operation, but instead classifies this as unit operation 44, washing of finished products.

7 **Alkaline Treatment Without Cyanide** is a general term used to describe the application of an alkaline solution, not containing cyanide, to a metal surface to clean the metal surface or prepare the metal surface for further surface finishing. Alkaline treatment includes alkaline cleaning and emulsion cleaning as described under unit operation 5.

8 **Anodizing With Chromium** involves producing a protective oxide film on aluminum, magnesium, or other light metal, usually by passing an electric current through an electrolyte bath in which the metal is immersed. Anodizing may be followed by a sealant operation.

Chromic acid anodic coatings have a relatively thick boundary layer and are more protective than sulfuric acid coatings. For these reasons, chromic acid is sometimes used when the part cannot be completely rinsed. These oxide coatings provide corrosion protection, decorative surfaces, a base for painting and other coating processes, and special electrical and mechanical properties.

Wastewater generated from anodizing includes spent anodizing solutions, sealants, and rinse waters. Because of the anodic nature of the process, anodizing solutions become contaminated with the base metal being processed. These solutions eventually reach an intolerable concentration of dissolved metal and require treatment or disposal. Rinse water following anodizing, coloring, and sealing steps is typically discharged to treatment.

- 9 **Anodizing Without Chromium** involves producing of a protective oxide film on aluminum, magnesium, or other light metal, usually by passing an electric current through an electrolyte bath in which the metal is immersed. Phosphoric acid, sulfuric acid, and boric acid, are all types of anodizing. Anodizing may also include sealant baths. These oxide coatings provide corrosion protection, decorative surfaces, a base for painting and other coating processes, and special electrical and mechanical properties.

Wastewater generated from anodizing includes spent anodizing solutions, sealants, and rinse waters. Because of the anodic nature of the process, anodizing solutions become contaminated with the base metal being processed. These solutions eventually reach an intolerable concentration of dissolved metal and require treatment or disposal. Rinse water following anodizing, coloring, and sealing steps typically discharged to treatment.

- 10 **Aqueous Degreasing** involves cleaning metal parts using aqueous-based cleaning chemicals primarily to remove residual oils and greases from a part. Residual oils can be from previous operations (e.g., machine coolants), oil from product use in a dirty environment, or oil coatings intended to inhibit corrosion. Wastewater generated by this operation includes spent cleaning solutions and rinse waters.

- 11 **Assembly/Disassembly** involves fitting together previously manufactured or rebuilt parts or components into a complete metal product or machine or taking a complete metal product or machine apart. Assembly/disassembly operations are typically dry; however, special circumstances can require water for cooling or buoyancy. Also, rinsing may be necessary under some conditions.

- 12 **Barrel Finishing (i.e., tumbling, mass finishing)** involves polishing or deburring a workpiece using a rotating or vibrating container and abrasive media or other polishing materials to achieve a desired surface appearance. Parts to be finished are placed in a rotating barrel or vibrating unit with an abrasive media (e.g., ceramic chips, pebbles), water, and chemical additives (e.g., alkaline detergents). As the barrel rotates, the upper layer of the part slides toward the lower side of the barrel, causing the abrading or polishing. Similar results can also be accomplished in a vibrating unit, where the entire contents of the container are in constant motion, or in a centrifugal unit, which compacts the load of media and parts as the unit spins and generates up to 50 times the force of gravity. Spindle finishing is a similar process, where parts to be finished are mounted on fixtures and exposed to a rapidly moving abrasive slurry.

Wastewater generated by barrel finishing includes spent process solutions and rinses. Following the finishing process, the contents of the barrel are unloaded. Process wastewater is either discharged continuously during the process,

discharged after finishing, or collected and reused. The parts are sometimes given a final rinse to remove particles of abrasive media from part surfaces.

- 13 **Burnishing** involves finish sizing or smooth finishing a workpiece (previously machined or ground) by displacing, rather than removing, minute surface irregularities with smooth point or line-contact, fixed or rotating tools. Lubricants or soap solutions can be used to cool tools used in burnishing operations. Wastewater is generated from burnishing operations through process solution discharges and rinsing.

- 14 **Chemical Conversion Coating without Chromium** is the process of applying a protective coating on the surface of a metal without using chromium. Such coatings include metal phosphates, metal coloring, passivation, or other coatings. These coatings are applied to a base metal or previously deposited metal to increase corrosion protection and lubricity, prepare the surface for additional coatings, or formulate a special surface appearance. This unit operation includes sealant operations using additives other than chromium.

- C **Phosphate conversion coatings** are applied for one or more of the following reasons: to provide a base for paints and other organic coatings; to condition surfaces for cold forming operations by providing a base for drawing compounds and lubricants; to impart corrosion resistance to the metal surface; or to provide a suitable base for corrosion-resistant oils or waxes. Phosphate conversion coatings are formed by immersing a metal part in a dilute solution of phosphoric acid, phosphate salts, and other reagents.
- C **Metal coloring** by chemical conversion coating produces a large group of decorative finishes. Metal coloring includes the formation of oxide conversion coatings. In this operation, the metal surface is converted into an oxide or similar metallic compound, giving the part the desired color. The most common colored finishes are used on copper, steel, zinc, and cadmium.
- C **Passivation** forms a protective film on metals, particularly stainless steel, by immersing parts in an acid solution. Stainless steel is passivated to dissolve embedded iron particles and to form a thin oxide film on the surface of the metal.

Wastewater generated by chemical conversion coating operations includes spent process solutions and rinses (i.e., both the chemical conversion coating solutions and post-treatment sealant solutions). These solutions are commonly discharged to treatment when contaminated with the base metal or other impurities. Rinsing

normally follows each process step, except after some sealants, which dry on the part surface.

- 15 **Chemical Milling (or Chemical Machining)** involves removing metal from a workpiece by controlled chemical attack, or etching, to produce desired shapes and dimensions. In chemical machining, a masking agent is typically applied to cover a portion of the part's surface; the exposed (unmasked) surface is then treated with the chemical machining solution.

Wastewater generated by chemical machining operations includes spent process solutions and rinses. Process solutions are commonly discharged after becoming contaminated with the base metal. Rinsing normally follows chemical machining.

- 16 **Chromate Conversion Coating (or chromating)** involves forming a conversion coating (protective coating) on a metal by immersing or spraying the metal with a hexavalent chromium compound solution to produce a hexavalent and/or trivalent chromium compound coating. This is also known as chromate treatment, and is most often applied to aluminum, zinc, cadmium or magnesium surfaces. Sealant operations using chromium are also included in this unit operation.

Chromate solutions include two types: (1) those that deposit substantial chromate films on the substrate metal and are complete treatments themselves, and (2) those that seal or supplement oxide, phosphate, or other types of protective coatings.

Wastewater generated by chromate conversion coating operations includes spent process solutions (i.e., both the chromate conversion coating solutions and post-treatment sealant solutions) and rinses. These solutions are commonly discharged to treatment when contaminated with the base metal or other impurities. Also, chromium-based solutions, which are typically formulated with hexavalent chromium, lose operating strength when the hexavalent chromium reduces to trivalent chromium during use. Rinsing normally follows each process step, except after some sealants, which dry on the surface of the part.

- 17 **Corrosion Preventive Coating** involves applying removable oily or organic solutions to protect metal surfaces against corrosive environments. Corrosion preventive coatings include, but are not limited to: petrolatum compounds, oils, hard dry-film compounds, solvent-cutback petroleum-based compounds, emulsions, water-displacing polar compounds, and fingerprint removers and neutralizers. Corrosion preventive coating does not include electroplating or chemical conversion coating (including phosphate conversion coating) operations.

Many corrosion preventive materials are also formulated to function as lubricants or as a base for paint. Typical applications include: assembled machinery or equipment in standby storage; finished parts in stock or spare parts for

replacement; tools such as drills, taps, dies, and gauges; and mill products such as sheet, strip, rod and bar.

Wastewater generated from corrosion preventive coating operations includes spent process solutions and rinses. Process solutions are discharged when they become contaminated with impurities or are depleted of constituents. Corrosion preventive coatings do not typically require an associated rinse, but parts are sometimes rinsed to remove the coating before further processing.

- 18 **Electrical Discharge Machining** involves removing metals by a rapid spark discharge between different polarity electrodes, one the workpiece and the other the tool, separated by a small gap. The gap may be filled with air or a dielectric fluid. This operation is used primarily to cut tool alloys, hard nonferrous alloys, and other hard-to-machine materials. Most electrical discharge machining processes are operated dry. In some cases, water is used in the process, which generates wastewater of water-based dielectric fluids.
- 19 **Electrochemical Machining** is a process in which the workpiece becomes the anode and a shaped cathode is the cutting tool. By pumping electrolyte between the electrodes and applying a potential, metal is rapidly but selectively dissolved from the workpiece. Wastewater generated by electrochemical machining includes spent electrolytes and rinses.
- 20 **Electroless Plating** involves deposition of a metallic coating by a controlled chemical reduction that is catalyzed by the substitute material being deposited without using an electrical current. The metal to be plated onto a part is typically held in solution at high concentrations by the use of a chelating agent. This operation plates all areas of the part to a uniform thickness regardless of the configuration of the part. Also, an electroless-plated surface is dense and virtually nonporous. Copper and nickel electroless plating are the most common.

Sealant operations (i.e., other than hot water dips) performed following this operation are considered separate unit operations if they include any additives.

Wastewater generated from electroless plating operations includes spent process solutions and rinses. This wastewater contain chelated metals, which require separate preliminary treatment to break the metal chelates prior to conventional chemical precipitation. Rinsing follows most electroless plating processes to remove residual plating solution and prevent contamination of subsequent process baths.
- 21 **Electrolytic Cleaning** involves removing soil, scale, or surface oxides from a workpiece by electrolysis. The workpiece is one of the electrodes and the

electrolyte is usually alkaline. Electrolytic alkaline cleaning and electrolytic acid cleaning are the two types of electrolytic cleaning. They are described below.

- C **Electrolytic alkaline cleaning** produces a cleaner surface than nonelectrolytic methods of alkaline cleaning. This method uses strong agitation, gas evolution in the solution, and oxidation-reduction reactions that occur during electrolysis. In addition, dirt particles become electrically charged and are repelled from the part surface.
- C **Electrolytic acid cleaning** is sometimes used as a final cleaning before electroplating. Sulfuric acid is most frequently used as the electrolyte. As with electrolytic alkaline cleaning, the mechanical scrubbing effect from the evolution of gas enhances the effectiveness of the process.

Wastewater generated from electrolytic cleaning operations includes spent process solutions and rinses. Electrolytic cleaning solutions become contaminated during use due to the base metal dissolving and the introduction of contaminants. The solution is typically batch discharged for treatment or disposal after it weakens. Following electrolytic cleaning, rinsing is used to remove residual cleaner and prevent the contamination of subsequent process baths.

22

Electroplating with Chromium involves producing a chromium metal coating on a surface by electrodeposition. Electroplating provides corrosion protection, wear or erosion resistance, lubricity, electrical conductivity, or decoration.

In electroplating, metal ions in acid, alkaline, or neutral solutions are reduced on the cathodic surfaces of the parts being plated. Metal salts or oxides are typically added to replenish solutions. Chromium trioxide is often added as a source of chromium.

In addition to water and the metal being deposited, electroplating solutions often contain agents that form complexes with the metal being deposited, stabilizers to prevent hydrolysis, buffers for pH control, catalysts to assist in deposition, chemical aids to dissolve anodes, and miscellaneous ingredients that modify the process to attain specific properties. Sealant operations (i.e., other than hot water dips) performed after this operation are considered separate unit operations if they include any additives.

Wastewater generated from electroplating operations includes spent process solutions and rinses. Electroplating solutions occasionally become contaminated during use due to the base metal dissolving and/or the introduction of other contaminants. As this happens, the performance of the electroplating solutions diminishes. Spent concentrated solutions are typically treated for contaminant removal and reused, processed in a wastewater treatment system, or sent off site

for disposal. Rinse waters, including some drag-out rinse tank solutions, are typically treated on site.

- 23 **Electroplating with Cyanide** involves producing metal coatings on a surface by electrodeposition, using cyanide. Electroplating provides corrosion protection, wear or erosion resistance, lubricity, electrical conductivity, or decoration.

In electroplating, metal ions in acid, alkaline, or neutral solutions are reduced on the cathodic surfaces of the parts being plated. The metal ions in solution are typically replenished by dissolving metal from anodes contained in inert wire or metal baskets. Sealant operations performed after this operation are considered separate unit operations if they include any additives (i.e., any sealant operations other than hot water dips).

In addition to water and the metal being deposited, electroplating solutions often contain agents that form complexes with the metal being deposited, stabilizers to prevent hydrolysis, buffers for pH control, catalysts to assist in deposition, chemical aids for dissolving anodes, and miscellaneous ingredients that modify the process to attain specific properties. Cyanide, usually in the form of sodium or potassium cyanide, is frequently used as a complexing agent for zinc, cadmium, copper, and precious metal baths.

Wastewater generated from electroplating operations includes spent process solutions and rinses. Electroplating solutions occasionally become contaminated during use due to dissolution of the base metal and/or the introduction of other contaminants. As this happens, the performance of the electroplating solutions diminishes. Spent concentrated solutions are typically treated for contaminant removal and reused, processed in a wastewater treatment system, or sent off site for disposal. Rinse waters, including some drag-out rinse tank solutions, are typically treated on site.

- 24 **Electroplating without Chromium or Cyanide** involves the production of metal coatings on a surface by electrodeposition, without the use of chromium or cyanide. Commonly electroplated metals include nickel, copper, tin/lead, gold, and zinc. Electroplating is performed to provide corrosion protection, wear or erosion resistance, lubricity, electrical conductivity, or decoration.

In electroplating, metal ions in acid, alkaline, or neutral solutions are reduced on the cathodic surfaces of the parts being plated. The metal ions in solution are typically replenished by dissolving metal from anodes contained in inert wire or metal baskets. Sealant operations performed after this operation are considered separate unit operations if they include any additives (i.e., any sealant operations other than hot water dips).

In addition to water and the metal being deposited, electroplating solutions often contain agents that form complexes with the metal being deposited, stabilizers to prevent hydrolysis, buffers for pH control, catalysts to assist in deposition, chemical aids for dissolving anodes, and miscellaneous ingredients that modify the process to attain specific properties.

Wastewater generated from electroplating operations includes spent process solutions and rinses. Electroplating solutions occasionally become contaminated during use due to dissolution of the base metal and/or the introduction of other contaminants. As this happens, the performance of the electroplating solutions diminishes. Spent concentrated solutions are typically treated for contaminant removal and reused, processed in a wastewater treatment system, or sent off site for disposal. Rinse waters, including some drag-out rinse tank solutions, are typically treated on site.

- 25 **Electropolishing** involves producing a highly polished surface on a workpiece using reversed electrodeposition in which the anode (workpiece) releases some metal ions into the electrolyte to reduce surface roughness. When current is applied, a polarized film forms on the metal surface, through which metal ions diffuse. In this process, areas of surface roughness on parts serve as high-current density areas and are dissolved at rates greater than the smoother portions of the metal surface.

Metals are electropolished to improve appearance, reflectivity, and corrosion resistance. Base metals processed by electropolishing include aluminum, copper, zinc, low-alloy steel, and stainless steel. Common electrolytes include sodium hydroxide and combinations of sulfuric acid, phosphoric acid, and chromic acid.

Wastewater generated from electropolishing operations includes spent process solutions and rinses. Eventually, the concentration of dissolved metals increases beyond tolerable levels and the process becomes ineffective. Typically, a portion of the bath is decanted and some fresh chemicals are added, or the entire solution is discharged to treatment and replaced with fresh chemicals. Rinsing can involve several steps and can include hot immersion or spray rinses.

- 26 **Floor Cleaning (in process area)** removes dirt, debris, process solution spills, etc., from process area floors. Floors can be cleaned using wet or dry methods, such as vacuuming, mopping, dry sweeping, and hose rinsing. Nonprocess area floor cleaning in offices and other areas is not included in this unit operation.

- 27 **Grinding** involves removing stock from a workpiece by using abrasive grains held by a rigid or semirigid binder. Grinding shapes or deburrs the workpiece.

The grinding tool is usually a disk (the basic shape of grinding wheels), but can also be a cylinder, ring, cup, stick, strip, or belt. The most commonly used abrasives are aluminum oxide, silicon carbide, and diamond. The process may use a grinding fluid to cool the part and remove debris or metal fines.

Wastewater generated from grinding operations includes spent coolants and rinses. Metal-working fluids become spent for a number of reasons, including increased biological activity (i.e., the fluids become rancid) or decomposition of the coolant additives. Rinse waters are typically assimilated into the working fluid or treated on site.

28 **Heat Treating** involves modifying the physical properties of a workpiece by applying controlled heating and cooling cycles. This operation includes tempering, carburizing, cyaniding, nitriding, annealing, aging, normalizing, austenitizing, austempering, siliconizing, martempering, and malleablizing. Parts are heated in furnaces or molten salt baths, and then may be cooled by quenching in aqueous solutions (e.g., brine solutions), neat oils (pure oils with little or no impurities), or oil/water emulsions. Heat treating is typically a dry operation. It is considered a wet operation if aqueous quenching solutions are used. Wastewater can be generated from spent quench water and rinses.

29 **Impact Deformation** involves applying impact force to a workpiece to permanently deform or shape it. Impact deformation may include mechanical operations such as hammer forging, shot peening, peening, coining, high-energy-rate forming, heading, or stamping.

Impact deformation operations use natural and synthetic oils, light greases, and pigmented lubricants. Pigmented lubricants include whiting, lithapone, mica, zinc oxide, molybdenum disulfide, bentonite, flour, graphite, white lead, and soap-like materials.

These operations are typically dry, but wastewater can be generated from lubricant discharge and from rinsing operations associated with the process.

30 **Machining** involves removing stock from a workpiece (as chips) by forcing a cutting tool against the workpiece. This definition includes machining operations such as turning, milling, drilling, boring, tapping, planing, broaching, sawing, cutoff, shaving, shearing, threading, reaming, shaping, slotting, hobbing, and chamfering. Machining operations use various types of metal working fluids, the choice of which depends on the type of machining being performed and the preference of the machine shop. The fluids can be categorized into four groups: straight oil (neat oils), synthetic, semisynthetic, and water-soluble oil.

Machining operations generate wastewater from working fluid or rinse water discharge. Metal working fluids are periodically discarded because of reduced performance or development of a rancid odor. After machining, parts are sometimes rinsed to remove coolant and metal chips. The coolant reservoir is sometimes rinsed, and the rinse water is added to the working fluid.

- 31 **Metal Spraying (including water curtain)** involves applying a metallic coating to a workpiece by projecting molten or semimolten metal particles onto a substrate. Coatings can be sprayed from rod or wire stock or from powdered material. The process involves feeding the material (e.g., wire) into a flame where it is melted. The molten stock is then stripped from the end of the wire and atomized by a high-velocity stream of compressed air or other gas, which propels the material onto a prepared substrate or part.

Metal spraying coatings are used in a wide range of special applications, including: insulating layers in applications such as induction heating coils; electromagnetic interference shielding; thermal barriers for rocket engines; nuclear moderators; films for hot isostatic pressing; and dimensional restoration of worn parts.

Metal spraying is sometimes performed in front of a “water curtain” (a circulated water stream used to trap overspray) or a dry filter exhaust hood that captures the overspray and fumes. With water curtain systems, water is recirculated from a sump or tank. Wastewater is generated when the sump or tank is periodically discharged. Metal spraying is not typically followed by rinsing.

- 32 **Painting-Spray or Brush (including water curtains)** involves applying an organic coating to a workpiece. The application of coatings such as paint, varnish, lacquer, shellac and plastics uses processes such as spraying, brushing, roll coating, lithographing, powder coating, and wiping.

Water is used in painting operations as a solvent (water-borne formulations) for rinsing, for cleanup, and for water-wash (or curtain) type spray booths. Paint spray booths typically use most of the water in this unit operation. Spray booths capture overspray (i.e., paint that misses the product during application), and control the introduction of contaminants to the workplace and environment.

- 33 **Painting-Immersion (including electrophoretic, “e-coat”)** involves applying an organic coating to a workpiece using technology-based processes such as autophoretic and electrophoretic painting, described below.

C **Autophoretic Painting** is the application by nonelectrophoresis of an organic paint film when a workpiece is immersed in a suitable aqueous bath.

- C **Electrophoretic Painting** is coating a workpiece by making it either anodic or cathodic in a bath that is generally an aqueous emulsion of the organic coating material.
- C **Other Immersion Painting** includes all other types of immersion painting such as dip painting.

Water is used in immersion paint operations as a carrier for paint particles and to rinse the part. Aqueous painting solutions and rinses are typically treated through an ultrafiltration system. The concentrate is returned to the painting solution, and the permeate is reused as rinse water. Sites typically discharge a bleed stream to treatment. The painting solution and rinses are periodically batch-discharged to treatment.

- 34 **Plasma Arc Machining** involves material removal or shaping of a workpiece by a high-velocity jet of high-temperature, ionized gas. In plasma arc machining, a gas (nitrogen, argon, or hydrogen) is passed through an electric arc, causing the gas to become ionized, and heated to temperatures exceeding 16,650EC (30,000EF). The relatively narrow plasma jet melts and displaces the material in its path. Because plasma machining does not depend on a chemical reaction between the gas and the part, and because plasma temperatures are extremely high, the process can be used on almost any metal, including those that are resistant to oxygen-fuel gas cutting. The method is used mainly for profile cutting of stainless steel and aluminum alloys.

Although plasma arc machining is typically a dry process, water is used for water injection plasma arc torches. In these cases, a constricted swirling flow of water surrounds the cutting arc. This operation may also be performed immersed in a water bath. In both cases, the water is used to stabilize the arc, to cool the part, and to contain smoke and fumes.

- 35 **Polishing** involves removing stock from a workpiece by the action of loose or loosely held abrasive grains carried to the workpiece by a flexible support. Usually, the amount of stock removed in a polishing operation is only incidental to achieving a desired surface finish or appearance. Buffing is included in the polishing unit operation. It is usually performed using a revolving cloth or sisal buffing wheel, which is coated with a suitable compound. Liquid buffing compounds are used extensively for large-volume production on semiautomated or automated buffing equipment. Polishing operations are typically dry, although some operations are performed with liquid compounds or associated rinses.

- 36 **Pressure Deformation** involves applying force (other than impact force) to permanently deform or shape a workpiece. Pressure deformation operations may

include operations such as rolling, drawing, bending, embossing, sizing, extruding, squeezing, spinning, necking, forming, crimping or flaring.

Natural and synthetic oils, light greases, and pigmented lubricants are used in pressure deformation operations. Pigmented lubricants include whiting, lithapone, mica, zinc oxide, molybdenum disulfide, bentonite, flour, graphite, white lead, and soap-like materials.

Pressure deformation is typically dry, but wastewater is sometimes generated from the discharge of lubricants or from rinsing operations associated with the process.

37 **Salt Bath Descaling** involves removing surface oxides or scale from a workpiece by immersion of the workpiece in a molten salt bath or hot salt solution. Salt bath descaling solutions can contain molten salts, caustic soda, sodium hydride, and chemical additives. Molten salt baths are used in a salt bath-water quench-acid dip sequence to remove oxides from stainless steel and other corrosion-resistant alloys. In this process, the part is typically immersed in the molten salt, quenched with water, and then dipped in acid. Oxidizing, reducing, or electrolytic salt baths can be used depending upon the oxide to be removed. Wastewater generated from salt bath descaling operations includes spent process solutions, quenches, and rinses.

38 **Soldering** involves joining metals by inserting a thin (capillary thickness) layer of nonferrous filler metal into the space between them. Bonding results from the intimate contact produced by the metallic bond formed between the substrate metal and the solder alloy. The term soldering is used where the melting temperature of the filler is below 425EC (800EF). Some soldering operations use a solder flux, which is an aqueous or nonaqueous material used to dissolve, remove, or prevent the formation of surface oxides on the part.

Except for the use of aqueous fluxes, soldering is typically a dry operation; however, a quench or rinse sometimes follows soldering to cool the part or remove excess flux or other foreign material from its surface. Recent developments in soldering technology have focused on fluxless solders and fluxes that can be cleaned off with water.

39 **Solvent Degreasing** removes oils and grease from the surface of a part by using organic solvents, including aliphatic petroleum (e.g., kerosene, naphtha), aromatics (e.g., benzene, toluene), oxygenated hydrocarbons (e.g., ketones, alcohol, ether), and halogenated hydrocarbons (e.g., 1,1,1-trichloroethane, trichloroethylene, methylene chloride).

Solvent cleaning can be accomplished in either the liquid or vapor phase. Solvent vapor degreasing is normally quicker than solvent liquid degreasing. However,

ultrasonic vibration is sometimes used with liquid solvents to decrease the required immersion time with complex shapes. Solvent cleaning is often used as a precleaning operation prior to alkaline cleaning, as a final cleaning of precision parts, or as a surface preparation for some painting operations. Solvent degreasing operations are typically not followed by rinsing, although rinsing is performed in some cases.

- 40 **Stripping (paint)** involves removal of a paint (or other organic) coating from a metal basis material. Stripping is commonly performed as part of the manufacturing process to recover parts that have been improperly coated or as a part of maintenance and rebuilding to restore parts to a usable condition.

Organic coatings (including paint) are stripped using thermal, mechanical, and chemical means. Thermal methods include burn-off ovens, fluidized beds of sand, and molten salt baths. Mechanical methods include scraping and abrasive blasting (see unit operation 1). Chemical paint strippers include alkali solutions, acid solutions, and solvents (e.g., methylene chloride).

Wastewater generated from organic coating stripping operations includes process solutions (limited mostly to chemical paint strippers and rinses).

- 41 **Stripping (metallic coating)** involves removing a metallic coating from a metal basis material. Stripping is commonly performed as part of the manufacturing process to recover parts that have been improperly coated or as a part of maintenance and rebuilding to restore parts to a usable condition.

Metallic coating stripping most often uses chemical baths, although mechanical means (e.g., grinding, abrasive blasting) are also used. Chemical stripping is frequently performed as an aqueous electrolytic process.

Wastewater generated from metallic coating stripping operations includes process solutions and rinses. Stripping solutions become contaminated due to dissolution of the base metal. Typically, the entire solution is discharged to treatment. Rinsing is used to remove the corrosive film remaining on the parts.

- 42 **Testing** involves application of thermal, electrical, mechanical, hydraulic, or other energy to determine the suitability or functionality of a part, assembly or complete unit. Testing may also include the application of surface penetrant dyes to detect surface imperfections. Other types of tests frequently performed, which are typically dry but may generate wastewater under certain circumstances, include electrical testing, performance testing, X-ray testing, and ultrasonic testing. Testing is usually performed to replicate some aspect of the working environment. Wastewater generated from testing operations includes spent process solutions and rinses.

- 43 **Thermal Cutting** involves cutting, slotting or piercing a workpiece using an oxy-acetylene oxygen lance, electric arc cutting tool, or laser. Thermal cutting is typically a dry process, except for the use of contact cooling waters and rinses.
- 44 **Washing (finished products)** involves the cleaning of finished metal products after use or storage. This includes the use of fresh water or water containing a mild cleaning solution. This unit operation applies only to the finished products that do not require maintenance or rebuilding.
- 45 **Welding** involves joining two or more pieces of material by applying heat, pressure, or both, with or without filler material, to produce a metallurgical bond through fusion or recrystallization across the interface. Included in this definition are gas welding, resistance welding, arc welding, cold welding, electron beam welding, and laser beam welding. Welding is typically a dry process, except for the occasional use of contact cooling waters or rinses.
- 46 **Wet Air Pollution Control** involves the use of water to remove chemicals, fumes, or dusts that are entrained in air streams exhausted from process tanks or production areas. Most frequently, wet air pollution control devices are applied to electroplating, cleaning, and coating processes. A common type of wet air pollution control is the wet packed scrubber consisting of a spray chamber that is filled with packing material. Water is continuously sprayed onto the packing and the air stream is pulled through the packing by a fan. Contaminants in the air stream are absorbed by the water droplets and the air is released to the atmosphere. A single scrubber often serves numerous process tanks; however, the air streams are typically segregated by source into chromium, cyanide, and acid/alkaline sources.

Table 4-4 lists the less common unit operations identified from MP&M detailed surveys. Descriptions of these unit operations are contained in the public record for this rulemaking. Wastewater discharge flow from these operations represents less than 3 percent of the industry flow. Descriptions of unit operations applicable to the Steel Forming and Finishing Subcategory are listed in Section 14.1.5.

Table 4-4**Additional Water-Using Unit Operations Performed at MP&M Sites**

Unit Operation Name ^a	Number of Facilities Performing Unit Operation	Unit Operation Name ^a	Number of Facilities Performing Unit Operation
Acid Pickling Neutralization	35	Mechanical Plating	127
Adhesive Bonding	101	Multiple Unit Operation Rinse	462
Bilge Water	13	Phosphor Deposition	7
Calibration	33	Photo Image Developing	688
Carbon Black Deposition	73	Photo Imaging	7
Chromium Drag-out Reduction	6	Photo Resist Applications	20
Cyanide Rinsing	13	Solder Flux Cleaning	248
Dry Dock/Stormwater	21	Solder Fusing	144
Galvanizing/Hot Dip Coating	93	Steam Cleaning	22
Hot Dip Coating	63	Thermal Infusion	37
Kerfing	15	Vacuum Impregnation	51
Laundering	75	Water Shedder	12

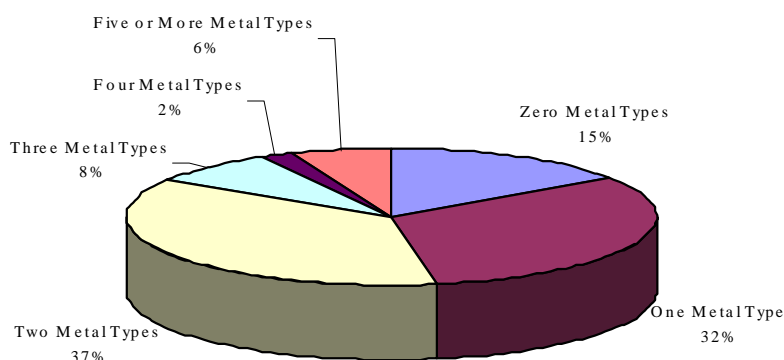
Source: MP&M Survey database.

^aEPA identified these unit operations based on responses to the 1989 and 1996 detailed survey mailouts.

4.2.3 Metal Types Processed

MP&M sites perform unit operations on a variety of metal types. Survey results identified 29 different metal types that are processed at MP&M sites. Of these, iron, aluminum, and copper are the base metals most frequently processed. Nickel, tin, lead, gold, and zinc are frequently processed as metals electroplated onto base metals.

Many MP&M sites also process more than one metal type on site. Figure 4-7 shows the percent of wastewater-discharging sites by number of metal types processed. As shown in Figure 4-7, more than half of the wastewater-discharging MP&M sites process more than one metal type on site.



Source: MP&M Survey Database.

Note: There are 62,749 wastewater - discharging MP&M sites. Zero metal types represent sites discharging process water only from floor cleaning of the metals processing area.

Figure 4-7. Number of MP&M Wastewater-Discharging Sites by Number of Metal Types Processed

4.2.4 Wastewater Discharge Volumes Generated

Process wastewater is used in many of the unit operations listed in Section 4.2.2. Some operations may be performed with and without water (wet or dry) depending on the purpose of the operation, raw materials, and final product use. For example, some machining operations (e.g., drilling) can often be performed without a coolant, while other machining operations (e.g., milling) typically require a coolant. Process wastewater may be recirculated, recycled or reused by one of the zero-wastewater-discharge methods described in Section 4.1.4, however, process wastewater is generally discharged to treatment or disposal.

Based on survey results, the most commonly performed wet unit operations are floor cleaning and acid treatment. Survey results also show the most commonly performed unit operations are not the ones generating the largest volumes of wastewater. Of the wastewater discharged, 79 percent is generated from associated rinses, with chemical conversion coating rinsing, acid treatment rinsing, and alkaline treatment rinsing generating the most wastewater. Table 4-5 summarizes which operations are typically performed without water, the number of MP&M sites that discharge process wastewater from each unit operation, and the total industry discharge flow from each unit operation.

Table 4-5

**Number of MP&M Sites Discharging Process Wastewater
by Unit Operation and Flow^a**

Survey Unit Operation Number	Unit Operation Description	Typically Performed Dry	Estimated Number of MP&M Sites Discharging Wastewater from Unit Operation	Total Estimated Industry Discharge Flow from Unit Operation^b (gpy)
1	Abrasive Blasting	T	609	38,778,160
1R.	Abrasive Blasting Rinse		667	305,528,295
2	Abrasive Jet Machining	T	1,072	39,977,953
3	Acid Treatment With Chromium		351	4,086,562
3R.	Acid Treatment With Chromium Rinse		429	364,766,772
4	Acid Treatment Without Chromium		5,690	416,840,116
4R.	Acid Treatment Without Chromium Rinse		6,574	17,754,706,129
5	Alkaline Cleaning for Oil Removal		6,253	1,401,562,927
5R.	Alkaline Cleaning for Oil Removal Rinse		4,400	8,625,499,609
6	Alkaline Treatment With Cyanide		204	4,729,476
6R.	Alkaline Treatment With Cyanide Rinse		252	74,087,698
7	Alkaline Treatment Without Cyanide		5,667	556,356,897
7R.	Alkaline Treatment Without Cyanide Rinse		4,185	7,906,960,561
8	Anodizing With Chromium		183	398,976
8R.	Anodizing With Chromium Rinse		194	205,226,036
9	Anodizing Without Chromium		577	12,858,977
9R.	Anodizing Without Chromium Rinse		678	4,120,542,720
10	Aqueous Degreasing		19,148	637,940,485
10R.	Aqueous Degreasing Rinse		13,718	631,789,542
11	Assembly/Disassembly	T	960	62,328,594
11R.	Assembly/Disassembly Rinse		836	2,086,711
12	Barrel Finishing		6,639	1,481,495,528
12R.	Barrel Finishing Rinse		2,820	596,393,341
13	Burnishing		2,311	137,710,275
13R.	Burnishing Rinse		1,447	333,474,479

Table 4-5 (Continued)

Survey Unit Operation Number	Unit Operation Description	Typically Performed Dry	Estimated Number of MP&M Sites Discharging Wastewater from Unit Operation	Total Estimated Industry Discharge Flow from Unit Operation^b (gpy)
14	Chemical Conversion Coating Without Chromium		4,387	1,231,117,839
14R.	Chemical Conversion Coating Without Chromium Rinse		4,815	25,297,218,112
15	Chemical Milling		726	43,500,663
15R.	Chemical Milling Rinse		1,258	1,095,828,156
16	Chromate Conversion Coating		1,900	73,476,786
16R.	Chromate Conversion Coating Rinse		2,115	2,146,579,879
17	Corrosion Preventive Coating	T	924	69,973,819
17R.	Corrosion Preventive Coating Rinse		463	686,365,140
18	Electrical Discharge Machining		729	1,714,162
18R	Electrical Discharge Machining Rinse		279	3,368,478
19	Electrochemical Machining		189	349,183,003
19R.	Electrochemical Machining Rinse		165	43,572,599
20	Electroless Plating		1,256	18,175,581
20R.	Electroless Plating Rinse		1,646	665,900,951
21	Electrolytic Cleaning		2,405	83,645,332
21R.	Electrolytic Cleaning Rinse		2,771	3,346,961,012
22	Electroplating With Chromium		557	30,135,241
22R.	Electroplating With Chromium Rinse		825	1,543,347,451
23	Electroplating With Cyanide		731	87,597,962
23R.	Electroplating With Cyanide Rinse		3,185	856,518,170
24	Electroplating Without Chromium or Cyanide		1,866	54,401,114
24R.	Electroplating Without Chromium or Cyanide Rinse		4,258	3,791,840,777
25	Electropolishing		255	4,485,954
25R.	Electropolishing Rinse		253	312,554,885
26	Floor Cleaning		33,326	3,559,210,563
26R.	Floor Cleaning Rinse		1,618	46,759,620
27	Grinding		2,193	202,036,389
27R.	Grinding Rinse		217	2,831,300,319
28	Heat Treating	T	789	196,798,353
28R.	Heat Treating Rinse		612	1,804,100,965

Survey Unit Operation Number	Unit Operation Description	Typically Performed Dry	Estimated Number of MP&M Sites Discharging Wastewater from Unit Operation	Total Estimated Industry Discharge Flow from Unit Operation ^b (gpy)
29	Impact Deformation	T	196	46,225,701
29R.	Impact Deformation Rinse		75	8,976,240
30	Machining		3,156	735,611,690
30R.	Machining Rinse		297	76,349,552
31	Metal Spraying	T	52	186,019
32	Painting - Spray or Brush		1,117	1,349,687,217
32R.	Painting - Spray or Brush Rinse		178	1,632,505,169
33	Painting - Immersion		271	237,430,089
33R.	Painting - Immersion Rinse		211	165,435,138
34	Plasma Arc Machining	T	458	11,893,377
35	Polishing	T	540	96,480,600
35R.	Polishing Rinse		491	1,687,785,986
36	Pressure Deformation	T	287	268,653,304
36R.	Pressure Deformation Rinse		92	1,105,233,854
37	Salt Bath Descaling		48	62,902
37R.	Salt Bath Descaling Rinse		67	56,171,145
38	Soldering/Brazing	T	663	425,693,444
38R.	Soldering/Brazing Rinse		1,966	264,719,840
39	Solvent Degreasing ^c	T	106	327,960
39R.	Solvent Degreasing Rinse		433	36,576,913
40	Stripping (Paint)		1,089	82,557,395
40R.	Stripping (Paint) Rinse		1,573	796,054,566
41	Stripping (Metallic Coating)		1,081	7,415,225
41R.	Stripping (Metallic Coating) Rinse		1,447	1,266,477,035
42	Testing		2,351	4,183,822,841
42R.	Testing Rinse		591	138,207,480
43	Thermal Cutting		124	104,662,316
43R.	Thermal Cutting Rinse		3	28
44	Washing Finished Products		16,862	2,563,540,125
44R.	Washing Finished Products Rinse		2,798	703,810,287
45	Welding	T	530	1,180,762,371
45R.	Welding Rinse		194	61,351,089
46	Wet Air Pollution Control		2,290	3,332,852,389

Source: MP&M Survey Database

^a MP&M Survey information was used to generate these estimated industry flows and site counts.

^b These totals do not include sites generating process wastewater that is contract hauled off site or not discharged.

^c Solvent degreasing operations reported as using process water are included under alkaline treatment (see unit operation #5).

4.3 Trends in the Industry

For the development of the MP&M rule, EPA collected data from the MP&M industry for over 10 years, including detailed surveys in 1990 and 1996. Survey data and industry site visits and sampling have shown numerous changes in the industry between 1990 and 1996. A greater number of facilities now have some type of wastewater treatment system in place. Survey data show a 30 percent industry increase in treatment systems between 1990 and 1996. Many sites have also begun to implement advanced treatment systems that include ultrafiltration for increased organics removal and microfiltration units to improve clarification. The MP&M survey database indicates that (in 1990) 260 of the facilities with wastewater treatment in place are currently using membrane filtration. By 1996, that number increased to 700. In addition, sites are moving toward greater implementation of pollution prevention and water reduction, including progression to zero discharge when possible. Fifty-three percent currently have in-process pollution prevention or water use reduction practices in place, and over 27 percent of discharging sites report having wet unit operations with zero discharge. Improvements in treatment controls are allowing for more automated process controls. This leads to more consistent wastewater treatment. Advances in wastewater treatment chemicals are also improving treatment efficiencies.

4.4 References

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5.0 WASTEWATER CHARACTERISTICS

This section summarizes the characteristics of wastewater generated from MP&M unit operations and raw wastewater entering wastewater treatment systems at MP&M facilities. EPA classified wastewater generated from MP&M unit operations into the following types based on composition and treatment requirements:

- C Hexavalent chromium-bearing wastewater;
- C Cyanide-bearing wastewater;
- C Oil- and organic pollutant-bearing wastewater;
- C Chelated metal-bearing wastewater; and
- C General metal-bearing wastewater.

Sections 5.1 through 5.5 summarize the unit operations generating each type of wastewater and the analytical data obtained from sampled MP&M unit operations and wastewater treatment influent streams. For each pollutant analyzed, EPA lists the number of samples analyzed, the number of times EPA detected the pollutant, and the minimum, maximum, mean, and median detected concentrations. EPA obtained analytical data for unit operations and wastewater treatment systems from the MP&M sampling program. EPA obtained additional analytical data from sampling conducted by sanitation districts and MP&M industry trade associations. Sections 3.1, 3.4, and 3.5 describe the MP&M sampling program and sampling episodes conducted by sanitation districts and MP&M industry trade associations. All data presented in this section have undergone complete analytical QA/QC.

During the MP&M sampling program, EPA collected 444 wastewater samples representing 50 distinct unit operations and rinses. These samples, which characterize unit operations that comprise approximately 90 percent of the total MP&M process wastewater discharge flow, are discussed in this section. The MP&M surveys identified an additional 20 unit operations and 24 rinses, accounting for approximately 10 percent of MP&M process wastewater discharge flow. EPA transferred data to these operations and rinses from the sampling data, based on process characteristics, as discussed in Section 12.1.2.

Unit operation-specific analytical data for the operations sampled during the MP&M sampling program are contained in the administrative record for this rulemaking.

5.1 Hexavalent Chromium-Bearing Wastewater

Hexavalent chromium-bearing wastewater contains elevated concentrations of hexavalent chromium along with other metals such as aluminum or iron. The wastewater is generally acidic. Sections 5.1.1 and 5.1.2 discuss hexavalent chromium-bearing wastewater generated from MP&M unit operations and as influent to chromium-reduction wastewater treatment units, respectively.

5.1.1 Unit Operations Generating Hexavalent Chromium-Bearing Wastewater

Table 5-1 summarizes the unit operations and associated rinses that generate hexavalent chromium-bearing wastewater and the number of samples collected of each.

Table 5-1

Number of Process and Rinse Samples for Unit Operations That Generate Hexavalent Chromium-Bearing Wastewater

Unit Operation	No. of Process Samples	No. of Rinse Samples
Acid Treatment with Chromium	1	3
Anodizing with Chromium	3	7
Chromate Conversion Coating	15	21
Electroplating with Chromium	4	14
Wet Air Pollution Control for Chromium-Bearing Operations	6	NA

Source: MP&M surveys and MP&M site visits.

NA - Not applicable. No associated rinse.

Hexavalent chromium is present in wastewater as a component of the process bath (e.g., chromic acid anodizing, chromate conversion coating, chromium electroplating). MP&M facilities install wet air pollution control devices to control air emissions of the chromium process bath constituents. Total and hexavalent chromium concentrations in process baths average 24,022 mg/L and 10 mg/L, respectively. In the associated rinses, the maximum concentration for total and hexavalent chromium from EPA's sampling was 17,300 mg/L and 21.2 mg/L, respectively. Table 5-2 summarizes the MP&M analytical data for total and hexavalent chromium in wastewater from unit operations and associated rinses that generate total and hexavalent chromium-bearing wastewater. Based on the process chemistry of the unit operations (e.g., chromium is present in the hexavalent form in a chromic acid solution), the Agency believes that some chromium present in this wastewater is in the hexavalent form. For the purposes of estimating compliance costs, the Agency assumed that all chromium in this wastewater is in the hexavalent form. EPA made this assumption to provide a conservative assessment of the costs associated with chromium reduction treatment. (See Section 11 for a discussion on EPA's Design and Cost Model).

Table 5-2

**Summary of Analytical Data for Chromium From Unit Operations and Rinses
Generating Chromium-Bearing Wastewater**

Source of Pollutant	Chromium Form	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
				Minimum	Maximum	Mean	Median
Unit Operations	Total	29	29	0.045	139,000	24,022	2,410
	Hexavalent	2	1	10	10	10	10
Rinses	Total	45	45	0.22	17,300	1,229	19.3
	Hexavalent	6	6	2.1	21.2	10.3	8

Source: MP&M sampling program.

5.1.2 Chromium-Bearing Raw Wastewater Characteristics

Typically, MP&M facilities segregate hexavalent chromium-bearing wastewater generated from the unit operations listed in Table 5-1 and treat it in a chromium reduction unit before commingling with other process wastewater for further treatment. Section 8.2.1 describes chromium reduction technologies used in the MP&M industry. This segregated wastestream requires preliminary treatment to reduce hexavalent chromium to trivalent chromium since hexavalent chromium is not effectively treated in chemical precipitation systems. Table 5-3 summarizes the analytical data for hexavalent chromium and total chromium in the raw influent to chromium reduction units. (See Section 10.0 for a discussion on achievable effluent concentrations of chromium following chromium reduction and chemical precipitation).

Table 5-3

**Summary of Analytical Data for Chromium in Chromium-Bearing Raw
Wastewater at Influent to Hexavalent Chromium Treatment**

Form of Chromium	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Total Chromium	51	51	2.41	432	57.8	19.5
Hexavalent Chromium	21	18	0.027	20	6.70	4.0

Source: MP&M sampling program.

5.2 Cyanide-Bearing Wastewater

Cyanide-bearing wastewater contains elevated concentrations of cyanide along with other metals such as copper, cadmium, or zinc. High concentrations of cyanide are typically found in electroplating baths. Cyanide may be analyzed as total cyanide (i.e., all forms included), amenable cyanide (i.e., cyanide present in forms amenable to treatment using alkaline chlorination), or weak-acid-dissociable cyanide (i.e., cyanide that dissociates in a weak acid). For the purposes of sizing and costing alkaline chlorination systems, EPA made the conservative assumption that all detected total cyanide was present in a form amenable to alkaline chlorination. Sections 5.2.1 and 5.2.2 discuss cyanide-bearing wastewater generated from MP&M unit operations and as influent to cyanide treatment units, respectively.

5.2.1 Unit Operations Generating Cyanide-Bearing Wastewater

Table 5-4 summarizes the unit operations and associated rinses that generate cyanide-bearing wastewater and the number of samples collected of each.

Table 5-4
Number of Process and Rinse Samples for Unit Operations
That Generate Cyanide-Bearing Wastewater

Unit Operation	No. of Process Samples	No. of Rinse Samples
Alkaline Treatment with Cyanide	2	4
Electroplating with Cyanide	8 ^a	23
Wet Air Pollution Control for Cyanide-Bearing Operations	3	NA

Source: MP&M surveys and MP&M site visits.

NA - Not applicable. No associated rinse.

^a Does not include one sample from a gold-cyanide electroplating bath that was only analyzed for metals.

Cyanide is present as a component of electroplating and cleaning baths and in wet air pollution control wastewater for cyanide-bearing unit operations. Table 5-5 summarizes the analytical data for total and amenable cyanide collected during the MP&M sampling program from individual unit operations and their associated rinses that generate cyanide-bearing wastewater. Cyanide electroplating baths and rinses also contain several metal pollutants (typically cadmium, copper, or silver) depending on the type of metal being electroplated.

Table 5-5

**Summary of Analytical Data for Cyanide from Unit Operations and Rinses
Generating Cyanide-Bearing Wastewater**

Source of Pollutant	Cyanide Form	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
				Minimum	Maximum	Mean	Median
Unit Operations	Total	13	13	0.12	100,000	18,964	9,370
	Amenable	0	NA	NA	NA	NA	NA
Rinses	Total	24	24	0.054	51,000	5,663	12
	Amenable	1	1	0.34	0.34	0.34	0.34

Source: MP&M sampling program.

NA - Not applicable. No samples were analyzed for amenable cyanide.

5.2.2 Cyanide-Bearing Raw Wastewater Characteristics

Typically, MP&M facilities segregate cyanide-bearing wastewater generated from the unit operations listed in Table 5-4 and treat it in a cyanide destruction unit before commingling with other process wastewater for further treatment. This preliminary treatment prevents cyanide complexes from forming in the commingled wastewater. These complexes decrease the effectiveness of chemical precipitation. Section 8.2.3 discusses cyanide treatment technologies. Table 5-6 summarizes the analytical data for cyanide in the influent to cyanide treatment units. (See Section 10.0 for a discussion of achievable effluent concentrations of cyanide following cyanide destruction.)

Table 5-6

**Summary of Analytical Data for Cyanide in Cyanide-Bearing Raw
Wastewater at Influent to Cyanide Treatment**

Source of Pollutant	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Total Cyanide	91	88	0.024	1,110	45.4	3.89
Amenable Cyanide	65	59	0.01	394	35.8	2.21

Source: MP&M sampling program.

5.3 Oil-Bearing and Organic Pollutant-Bearing Wastewater

Oil-bearing wastewater contains elevated concentrations of oil. This wastewater may need additional treatment for the removal of toxic organics. Oil-bearing wastewater is classified as either free oils or oil/water emulsions. Sections 5.3.1 and 5.3.2 discuss wastewater bearing oil and organic pollutants generated from MP&M unit operations and as influent to oily wastewater treatment units, respectively.

5.3.1 Unit Operations Generating Oil-Bearing and/or Organic Pollutant-Bearing Wastewater

Table 5-7 summarizes the unit operations and associated rinses that generate oil-bearing wastewater and the number of samples collected of each.

Table 5-7

Number of Process and Rinse Samples For Unit Operations That Generate Oil-Bearing and/or Organic Pollutant-Bearing Wastewater

Unit Operation	No. of Process Samples	No. of Rinse Samples
Alkaline Cleaning for Oil Removal	30	30
Aqueous Degreasing	12	6
Barrel Finishing	10	0
Bilge Water	1	0
Corrosion Preventive Coating	5	3
Dry Dock	4	0
Electrical Discharge Machining	1	0
Electrolytic Cleaning	7	14
Floor Cleaning	6	0
Grinding	5	0
Heat Treating	3	7
Impact Deformation	1	0
Machining	16	0
Painting - Spray or Brush	6	0
Painting - Immersion	1	2
Steam Cleaning	8	0
Solder Flux Cleaning	3	0
Solder Fusing	0	3
Testing	7	2
Thermal Cutting	2	0
Washing Finished Products	4	3

Source: MP&M surveys and MP&M site visits.

Tables 5-8 and 5-9 summarize the analytical data collected during the MP&M sampling program from individual unit operations that generate oil-bearing wastewater and their associated rinses, respectively. MP&M facilities typically use oil/water emulsions as coolants and lubricants in machining, grinding, and deformation operations. Oil is also present as a contaminant in wastewater from cleaning operations. The maximum concentration of oil and grease in wastewater sampled by EPA from these unit operations was 36,850 mg/L (from an alkaline cleaning bath), while the maximum concentration of oil and grease in the wastewater from the rinses associated with these unit operations was 9,195 mg/L.

As shown in Tables 5-8 and 5-9, the oil-bearing wastewater also contains numerous organic pollutants. These pollutants are either components of the oil/water emulsions or contaminants in the cleaning solutions. The maximum organic pollutant concentration found in

EPA samples was 19,813 mg/L of benzoic acid from a testing unit operation. The maximum organic pollutant concentration in the rinses was 160 mg/L for n-tetradecane from a testing rinse operation. Tables 5-8 and 5-9 show that these unit operations also contain conventional, non-conventional, and metal pollutants.

A major source of organic pollutants at MP&M facilities is solvent degreasing. Solvent degreasing operations use organic solvents such as trichloroethylene or mineral spirits, and do not use water. Therefore, for the purposes of the MP&M effluent guidelines, EPA did not consider waste from solvent degreasing a regulated wastewater. In rare situations, EPA identified rinses following solvent degreasing. EPA classified these rinses as MP&M wastewater. The Agency classified cleaning operations that use an emulsion of water and solvents as emulsion cleaning (a subset of alkaline cleaning) and considered these waste streams as MP&M regulated wastewater.

Table 5-8

Analytical Data for Unit Operations Generating Oil-Bearing and/or Organic-Bearing Wastewater

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,1,1-Trichloroethane	72	1	0.011	0.011	0.011	0.011
1,1,2,2-Tetrachloroethane	70	1	0.011	0.011	0.011	0.011
1,1,2-Trichloroethane	72	1	0.012	0.012	0.012	0.012
1,2-Dichlorobenzene	72	1	0.638	0.638	0.638	0.638
2,4,6-Trichlorophenol	72	1	0.014	0.014	0.014	0.014
2,4-Dimethylphenol	71	4	0.016	0.064	0.051	0.062
4-Chloro-3-Methylphenol	72	11	0.011	91.1	18.2	0.587
4-Nitrophenol	70	1	0.424	0.424	0.424	0.424
Acrolein	72	1	0.161	0.161	0.161	0.161
Acrylonitrile	72	1	0.061	0.061	0.061	0.061
Anthracene	72	1	0.193	0.193	0.193	0.193
Benzene	72	2	0.014	0.044	0.03	0.029
Bis(2-ethylhexyl) Phthalate	72	21	0.012	143	7.44	0.085
Bromodichloromethane	72	3	0.012	0.072	0.032	0.012
Butyl Benzyl Phthalate	72	1	0.066	0.066	0.066	0.066
Chlorobenzene	72	2	0.028	0.058	0.043	0.043
Chloroethane	72	1	8.34	8.34	8.34	8.34
Chloroform	72	5	0.010	0.019	0.014	0.013

Table 5-8 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants (continued)						
Chloromethane	72	1	0.069	0.069	0.069	0.069
Di-n-butyl Phthalate	72	4	0.012	0.070	0.038	0.035
Di-n-octyl Phthalate	72	1	0.020	0.020	0.020	0.020
Dibromochloromethane	72	2	0.010	0.011	0.011	0.011
Dimethyl Phthalate	72	2	0.021	2.000	1.010	1.010
Ethylbenzene	72	5	0.028	2.91	0.773	0.191
Fluoranthene	72	4	0.029	0.243	0.132	0.129
Fluorene	72	2	0.010	0.021	0.015	0.015
Methylene Chloride	72	3	0.028	6.76	2.27	0.030
n-nitrosodiphenylamine	72	1	0.025	0.025	0.025	0.025
Naphthalene	72	5	0.019	1.839	0.413	0.081
Phenanthrene	72	4	0.101	5.50	1.47	0.143
Phenol	72	21	0.012	8.84	1.05	0.05
Tetrachloroethene	72	2	0.015	0.02	0.02	0.018
Toluene	72	7	0.029	0.653	0.162	0.103
Trichloroethene	72	8	0.019	0.042	0.024	0.021
Priority Metal Pollutants						
Antimony	131	40	0.004	0.804	0.124	0.040
Arsenic	132	57	0.001	1.65	0.100	0.021
Beryllium	132	21	0.000	0.025	0.004	0.002
Cadmium	132	71	0.002	12.1	1.12	0.097
Chromium	132	104	0.007	255	5.43	0.136
Copper	132	123	0.006	190	6.58	0.660
Cyanide	10	7	0.004	0.232	0.078	0.059
Lead	132	78	0.006	1,450	29.9	0.538
Mercury	132	28	0.000	0.017	0.001	0.000
Nickel	132	94	0.013	80.9	2.24	0.164
Selenium	131	37	0.001	1.57	0.099	0.021
Silver	132	39	0.003	2.12	0.175	0.016
Thallium	131	20	0.001	0.113	0.021	0.018
Zinc	132	121	0.008	1,160	37.2	1.39
Conventional Pollutants						
BOD 5-day (Carbonaceous)	64	56	3	64,900	3,207	645
Oil And Grease	63	59	2.4	570,000	28,592	790

Table 5-8 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Conventional Pollutants (continued)						
Oil and Grease (as HEM)	66	50	7.75	36,850	2,351	211
pH	69	69	3.44	13.9	8.85	8.24
Total Suspended Solids	132	127	4	43,580	1,940	185
Nonconventional Organic Pollutants						
1,4-Dioxane	72	2	0.077	1.00	0.539	0.539
1-Methylfluorene	72	3	0.014	2.60	0.912	0.123
1-Methylphenanthrene	72	3	0.122	5.65	1.97	0.147
2-(Methylthio)Benzothiazole	72	1	0.028	0.028	0.028	0.028
2-Butanone	72	13	0.057	38.3	3.70	0.101
2-Hexanone	72	3	0.124	0.505	0.263	0.161
2-Isopropyl-naphthalene	72	1	7.34	7.34	7.34	7.34
2-Methylnaphthalene	72	9	0.011	3.14	0.511	0.236
2-Picoline	72	1	0.072	0.072	0.072	0.072
2-Propanone	72	40	0.060	11.9	0.966	0.220
3,6-Dimethylphenanthrene	72	1	8.50	8.5	8.50	8.50
4-Methyl-2-Pentanone	72	10	0.124	159	22.6	0.457
Acetophenone	72	1	0.566	0.566	0.566	0.566
Alpha-terpineol	71	12	0.012	14.1	2.69	1.780
Benzoic Acid	72	13	0.071	19,813	1,525	0.287
Benzyl Alcohol	72	3	0.023	0.208	0.108	0.094
Biphenyl	72	2	0.014	0.038	0.026	0.026
Cis-1,3-dichloropropene	72	1	0.012	0.012	0.012	0.012
Diphenyl Ether	72	1	0.013	0.013	0.013	0.013
Diphenylamine	72	2	0.024	0.026	0.025	0.025
Hexanoic Acid	72	24	0.019	1,490	66.3	0.903
Isobutyl Alcohol	72	3	0.012	1.31	0.446	0.018
m+p xylene	47	2	0.013	0.352	0.183	0.183
m-xylene	25	3	0.153	5.06	2.45	2.13
n,n-dimethylformamide	72	5	0.028	0.665	0.265	0.036
n-decane	72	9	0.017	1.33	0.462	0.132
n-docosane	72	23	0.013	141	7.98	0.164
n-dodecane	72	24	0.011	36.8	3.60	0.419
n-eicosane	72	29	0.012	14.1	1.40	0.190
n-hexacosane	72	20	0.011	109	7.43	0.099

Table 5-8 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)				
			Minimum	Maximum	Mean	Median	
Nonconventional Organic Pollutants (continued)							
n-hexadecane	72	28	0.015	95.3	6.64	0.444	
n-octacosane	72	8	0.035	61.1	10.4	0.524	
n-octadecane	72	28	0.01	264	13.1	0.198	
n-tetracosane	72	17	0.011	116	9.34	0.267	
n-tetradecane	72	29	0.011	48.5	6.48	0.674	
n-triacontane	72	12	0.012	31.9	3.78	0.433	
o+p xylene	25	3	0.063	2.01	1.19	1.48	
o-xylene	47	6	0.010	0.201	0.044	0.013	
p-cresol	72	6	0.010	4.31	0.74	0.029	
p-cymene	72	2	0.021	0.1	0.04	0.036	
Styrene	72	1	1.184	1.18	1.18	1.18	
Toluene, 2,4-diamino-	72	1	101	101	101	101	
Trichlorofluoromethane	72	1	0.106	0.106	0.106	0.106	
Tripropyleneglycol Methyl Ether	72	5	1.93	5,254	1,462	413	
Nonconventional Metal Pollutants							
Aluminum	132	113	0.039	414	22.3	1.83	
Barium	132	114	0.001	31.4	1.88	0.108	
Bismuth	1	1	0.058	0.058	0.058	0.058	
Boron	132	113	0.059	2,290	87.1	1.27	
Calcium	132	128	0.274	981	63.9	38.75	
Cobalt	132	54	0.005	1.26	0.131	0.037	
Gold	6	2	0.081	1.66	0.871	0.871	
Iridium	1	1	0.596	0.596	0.596	0.596	
Iron	132	126	0.016	2,790	50.2	6.10	
Lutetium	1	1	0.007	0.007	0.007	0.007	
Magnesium	132	121	0.088	213	24.6	10.5	
Manganese	132	122	0.002	24.1	1.36	0.271	
Molybdenum	132	87	0.003	774	11.7	0.095	
Neodymium	1	1	0.020	0.020	0.020	0.020	
Niobium	1	1	0.104	0.104	0.104	0.104	
Potassium	1	1	0.574	0.574	0.574	0.574	
Silicon	1	1	19.9	19.9	19.9	19.9	
Sodium	132	128	1.61	68,700	3,847	299	
Strontium	1	1	8.02	8.0186	8.02	8.02	

Table 5-8 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Metal Pollutants (continued)						
Sulfur	1	1	0.636	0.636	0.636	0.636
Tantalum	1	1	0.134	0.134	0.134	0.134
Tin	132	61	0.004	852	15.7	0.101
Titanium	132	86	0.001	30.0	0.658	0.045
Tungsten	1	1	0.175	0.175	0.175	0.175
Vanadium	132	51	0.005	0.482	0.072	0.023
Ytterbium	1	1	0.006	0.006	0.006	0.01
Yttrium	132	37	0.001	0.900	0.045	0.008
Other Nonconventional Pollutants						
Acidity	51	17	1.00	250,000	14,818	9.00
Ammonia As Nitrogen	43	36	0.160	1,600	71.8	2.54
Chemical Oxygen Demand (COD)	107	103	22.4	366,000	27,871	4,930
Chloride	52	49	2.00	48,000	1,604	180
Fluoride	59	56	0.130	35.0	3.92	1.35
Hexavalent Chromium	63	13	0.016	1.70	0.207	0.055
Sulfate	66	54	1.50	46,000	2,483	272.23
Total Alkalinity	53	52	51.5	92,000	13,989	2,000
Total Dissolved Solids	128	128	33.5	411,420	23,538	4,500
Total Kjeldahl Nitrogen	44	41	0.200	580	68.9	37.0
Total Organic Carbon (TOC)	67	63	4.26	118,000	7,184	471
Total Petroleum Hydrocarbons (As SGT-HEM)	65	42	6.00	6,230	481	52.5
Total Phosphorus	35	34	0.065	7,170	291	18.85
Total Recoverable Phenolics	105	87	0.005	33.8	1.67	0.197
Total Sulfide	9	5	1.00	11.0	4.40	2.00

Source: MP&M sampling program.

Table 5-9

**Analytical Data for Rinses Generating Oil-Bearing and/or
Organic-Bearing Wastewater**

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,1,1-Trichloroethane	40	1	0.023	0.023	0.023	0.023
1,1-Dichloroethane	40	1	0.039	0.039	0.039	0.039
2,6-Dinitrotoluene	40	1	0.616	0.616	0.616	0.616
4-Chloro-3-Methylphenol	40	2	0.023	0.050	0.037	0.037
Bis(2-Ethylhexyl) Phthalate	40	10	0.011	1.15	0.336	0.187
Bromodichloromethane	40	4	0.010	0.014	0.011	0.010
Chloroform	40	11	0.010	0.035	0.017	0.012
Di-n-butyl Phthalate	40	4	0.014	0.019	0.017	0.017
Ethylbenzene	40	3	0.021	0.039	0.029	0.028
Methylene Chloride	40	1	0.016	0.016	0.016	0.016
n-nitrosodi-n-propylamine	40	1	0.132	0.132	0.132	0.132
Naphthalene	40	3	0.021	2.01	0.892	0.643
Phenanthrene	40	1	0.527	0.527	0.527	0.527
Phenol	40	5	0.011	8.28	1.67	0.024
Toluene	40	2	0.011	0.045	0.028	0.028
Trichloroethene	40	6	0.011	0.022	0.02	0.02
Priority Metal Pollutants						
Antimony	69	18	0.0028	0.256	0.047	0.032
Arsenic	70	15	0.0013	0.303	0.037	0.008
Beryllium	70	5	0.0011	0.005	0.002	0.002
Cadmium	70	22	0.002	11.9	0.618	0.052
Chromium	70	41	0.009	104	2.88	0.159
Copper	70	59	0.008	14.7	0.958	0.144
Cyanide	2	2	0.010	1.45	0.730	0.730
Lead	70	23	0.031	6.89	1.17	0.495
Mercury	70	11	0.00005	0.001	0.0003	0.0002
Nickel	70	38	0.008	10.3	0.744	0.105
Selenium	69	5	0.001	0.232	0.082	0.031
Silver	70	16	0.004	0.081	0.022	0.010
Thallium	69	5	0.002	0.036	0.014	0.006
Zinc	70	53	0.009	46.7	2.28	0.134

Table 5-9 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Conventional Pollutants						
BOD 5-day (Carbonaceous)	38	34	4.00	12,900	1,209	179
Oil And Grease	23	16	1.35	2,700	440	41.5
Oil And Grease (As HEM)	38	27	5.00	9,195	472	42
pH	38	38	2.40	13.2	9.24	9.31
Total Suspended Solids	70	56	4.00	2,560	178	64.2
Nonconventional Organic Pollutants						
1,4-Dioxane	40	1	0.196	0.196	0.196	0.196
1-Methylfluorene	40	1	0.129	0.129	0.129	0.129
1-Methylphenanthrene	40	1	1.02	1.02	1.02	1.02
2-Butanone	40	3	0.074	0.126	0.093	0.078
2-Isopropylnaphthalene	40	1	1.57	1.57	1.57	1.57
2-Methylnaphthalene	40	1	1.10	1.10	1.10	1.10
2-Propanone	40	14	0.055	3.10	0.444	0.197
3,6-Dimethylphenanthrene	40	1	0.811	0.811	0.811	0.811
4-Methyl-2-Pentanone	40	2	0.190	17.4	8.80	8.80
Alpha-Terpineol	39	2	65.3	67.3	66.3	66.3
Benzoic Acid	40	6	0.108	6.61	1.76	1.05
Benzyl Alcohol	40	2	2.73	24.8	13.8	13.8
Hexanoic Acid	40	15	0.015	28.4	2.40	0.536
m+p xylene	25	1	0.104	0.10	0.104	0.104
m-xylene	15	2	0.036	0.08	0.056	0.056
n,n-dimethylformamide	40	1	0.011	0.011	0.011	0.011
n-decane	40	1	5.01	5.01	5.01	5.01
n-docosane	40	7	0.018	6.47	1.07	0.030
n-dodecane	40	6	1.77	53.3	15.3	7.24
n-eicosane	40	13	0.011	2.4	0.490	0.172
n-hexacosane	40	8	0.011	1.46	0.443	0.250
n-hexadecane	40	10	0.011	52.7	11.0	0.755
n-octacosane	40	4	0.041	1.37	0.624	0.540
n-octadecane	40	10	0.018	4.03	0.952	0.159
n-tetracosane	40	10	0.012	17.0	1.87	0.094
n-tetradecane	40	6	0.221	160	53.3	3.12
n-triacontane	40	4	0.030	0.477	0.217	0.180
o-cresoL	40	1	0.012	0.012	0.012	0.012
o-xylene	25	1	0.056	0.056	0.056	0.056
p-cymene	40	1	0.190	0.190	0.190	0.190
Phenothiazine	40	1	0.582	0.582	0.582	0.582

Table 5-9 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Organic Pollutants (continued)						
Trichlorofluoromethane	40	1	0.036	0.036	0.036	0.036
Tripropyleneglycol Methyl Ether	40	3	0.413	4.18	2.43	2.71
Nonconventional Metal Pollutants						
Aluminum	70	36	0.031	19.7	2.72	0.823
Barium	70	58	0.001	1.61	0.181	0.044
Boron	70	48	0.019	838	28.0	0.195
Calcium	70	66	0.940	175	34.8	22.8
Cobalt	70	11	0.007	0.546	0.102	0.024
Gold	4	2	0.056	0.086	0.071	0.071
Iron	70	53	0.034	453	18.1	0.275
Magnesium	70	65	0.137	37.3	9.69	8.00
Manganese	70	51	0.002	8.63	0.394	0.040
Molybdenum	70	36	0.006	187	5.34	0.023
Palladium	3	1	0.054	0.054	0.054	0.054
Sodium	70	68	1.63	19,100	603	87.2
Tin	70	25	0.006	10.9	1.18	0.056
Titanium	70	23	0.002	1.53	0.259	0.040
Vanadium	70	19	0.003	0.182	0.030	0.023
Yttrium	70	7	0.002	0.020	0.008	0.007
Other Nonconventional Pollutants						
Acidity	19	8	2.00	120	26.5	16.0
Ammonia as Nitrogen	13	8	0.02	0.920	0.439	0.43
Chemical Oxygen Demand (COD)	47	44	5.20	32,700	2,561	347
Chloride	19	19	3.00	64,500	3,435	22.0
Fluoride	19	19	0.11	135	7.80	0.710
Hexavalent Chromium	38	12	0.011	0.069	0.025	0.022
Sulfate	26	22	6.60	780	122	29.0
Total Alkalinity	19	18	24	3,800	518	195
Total Dissolved Solids	70	69	26	120,000	3,563	708
Total Kjeldahl Nitrogen	10	7	0.36	149	23	1.68
Total Organic Carbon (TOC)	38	35	2.66	10,100	867	120
Total Petroleum Hydrocarbons (As SGT-	37	19	5.00	7,367	455	28.0
Total Phosphorus	7	7	0.06	11.0	4.1	2.16
Total Recoverable Phenolics	48	37	0.0056	2.78	0.233	0.070
Total Sulfide	1	1	12.0	12.0	12.0	12.0

Source: MP&M sampling program.

5.3.2 Oil-Bearing and Organic Pollutant-Bearing Raw Wastewater Characteristics

Wastewater containing oil and organic pollutants generated from the unit operations listed in Table 5-7 generally requires treatment to separate oil from the wastewater. If the oils are free or floating, then the oil and water can be separated using physical means such as oil skimming or ultrafiltration. If the oil is emulsified, techniques such as chemical emulsion breaking may be required before physical separation. Oil/water separation technologies also remove organic pollutants that are more soluble in oil than in water. Sections 8.2.5 and 8.3.2 discuss oil-water separation technologies used in the MP&M industry. Table 5-10 summarizes the characteristics of raw wastewater influent to oily wastewater treatment systems. (See Section 10.0 for a discussion on achievable effluent concentrations of oil and grease and organics following oil/water separation and chemical precipitation.)

Table 5-10

Analytical Data for Oil-Bearing and Organic Pollutant-Bearing Raw Wastewater Streams at Influent to Oil/Water Separation

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,1,1-Trichloroethane	82	5	0.006	0.022	0.013	0.013
1,2-Dichlorobenzene	82	1	0.638	0.638	0.638	0.638
2,4-Dimethylphenol	81	2	0.017	0.270	0.144	0.144
2-Nitrophenol	82	1	0.025	0.025	0.025	0.025
4-Chloro-3-Methylphenol	82	18	0.247	3,834	706	101
Acenaphthene	82	5	0.006	1.82	0.396	0.025
Acrolein	77	1	0.168	0.168	0.168	0.168
Anthracene	82	1	0.007	0.007	0.007	0.007
Benzene	82	2	0.007	0.012	0.010	0.010
Bis(2-Ethylhexyl) Phthalate	81	62	0.007	216	6.66	0.157
Butyl Benzyl Phthalate	81	7	0.024	2.73	0.440	0.065
Carbon Tetrachloride (Tetrachloromethane)	82	3	0.011	0.046	0.025	0.017
Chloroform	82	6	0.010	0.038	0.019	0.016
Chloromethane	82	1	0.736	0.736	0.736	0.736
Di-n-butyl Phthalate	81	8	0.011	0.193	0.087	0.080
Di-n-octyl Phthalate	82	10	0.010	19.7	2.37	0.332
Ethylbenzene	82	18	0.010	0.260	0.077	0.036

Table 5-10 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants (continued)						
Fluorene	82	6	0.010	9.93	1.71	0.067
n-Nitrosodiphenylamine	82	5	0.025	2.59	1.34	1.69
Naphthalene	82	15	0.011	8.91	1.04	0.046
Phenanthrene	82	17	0.012	5.30	0.486	0.033
Phenol	81	31	0.018	27.1	1.31	0.138
Pyrene	81	2	0.031	1.01	0.521	0.521
Tetrachloroethene	82	1	0.006	0.006	0.006	0.006
Toluene	82	21	0.006	1.35	0.199	0.033
Priority Metal Pollutants						
Antimony	86	33	0.002	0.105	0.022	0.017
Arsenic	86	38	0.002	0.534	0.036	0.006
Beryllium	86	20	0.0002	0.187	0.036	0.002
Cadmium	86	62	0.002	12.1	0.805	0.030
Chromium	86	74	0.003	15.9	0.726	0.071
Copper	86	86	0.027	232	23.0	0.408
Lead	86	70	0.006	210	17.1	0.239
Mercury	86	26	0.0001	0.003	0.0009	0.0004
Nickel	86	71	0.012	18.4	0.913	0.155
Selenium	86	13	0.001	0.124	0.028	0.011
Silver	86	18	0.004	2.8	0.272	0.022
Thallium	86	6	0.001	0.068	0.012	0.001
Zinc	86	84	0.145	664	26.0	1.66
Conventional Pollutants						
BOD 5-Day (Carbonaceous)	75	69	4	21,300	2,745	675
Oil And Grease	86	84	8.33	261,500	12,149	872
Total Suspended Solids	86	84	6	100,000	3,712	260
Nonconventional Organic Pollutants						
1,4-Dioxane	77	2	0.080	0.105	0.093	0.093
1-Methylfluorene	77	10	0.010	1.72	0.223	0.020
1-Methylphenanthrene	77	9	0.015	1.23	0.243	0.027
1-Naphthylamine	77	1	0.034	0.034	0.034	0.034
2-(Methylthio)Benzothiazole	77	3	0.012	0.023	0.017	0.015
2-Butanone	77	9	0.130	0.483	0.287	0.256
2-Hexanone	77	2	0.505	0.512	0.509	0.509

Table 5-10 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Organic Pollutants (continued)						
2-IsopropylInaphthalene	77	2	0.421	3.49	1.96	1.96
2-MethylInaphthalene	77	17	0.029	13.0	1.17	0.132
2-Propanone	77	62	0.060	28.8	4.48	0.858
3,6-Dimethylphenanthrene	77	5	0.013	1.28	0.583	0.371
4-Methyl-2-Pentanone	77	10	0.073	6.72	0.835	0.153
Acetophenone	77	3	0.014	0.092	0.051	0.047
Alpha-Terpineol	77	32	0.011	189	19.9	1.59
Aniline	77	1	0.014	0.014	0.014	0.014
Benzoic Acid	77	4	0.108	0.522	0.288	0.261
Benzyl Alcohol	77	11	0.011	10.8	1.08	0.141
Biphenyl	77	10	0.014	1.54	0.220	0.054
Carbazole	77	1	0.035	0.035	0.035	0.035
Carbon Disulfide	77	5	0.045	0.466	0.312	0.369
Dibenzofuran	77	1	0.014	0.014	0.014	0.014
Dibenzothiophene	76	3	0.015	1.293	0.452	0.048
Diphenylamine	77	5	0.034	1.99	1.24	1.66
Hexanoic Acid	77	31	0.011	31.9	4.61	0.508
m+p-Xylene	39	11	0.023	0.457	0.169	0.139
m-Xylene	38	6	0.018	0.312	0.071	0.024
n,n-Dimethylformamide	77	2	0.014	0.023	0.019	0.019
n-Decane	77	32	0.013	27.7	2.94	0.086
n-Docosane	77	43	0.011	79.7	2.87	0.119
n-Dodecane	77	47	0.017	207	23.2	0.919
n-Eicosane	76	52	0.010	109	6.67	0.220
n-Hexacosane	77	32	0.014	217	9.09	0.169
n-Hexadecane	77	58	0.012	145	8.60	0.362
n-Nitrosomorpholine	77	2	0.012	0.135	0.074	0.074
n-Octacosane	77	8	0.075	70.7	16.1	6.17
n-Octadecane	77	59	0.011	162	6.43	0.273
n-Tetracosane	76	32	0.021	56.8	3.32	0.248
n-Tetradecane	77	61	0.011	243	15.7	0.277
n-Triacontane	76	10	0.016	25.6	5.60	1.55
o+p-Xylene	38	6	0.011	0.030	0.021	0.021
o-Cresol	77	1	0.047	0.047	0.047	0.047

Table 5-10 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Organic Pollutants (continued)						
o-Xylene	39	14	0.012	0.130	0.065	0.071
p-Cresol	77	10	0.018	1.09	0.297	0.056
p-Cymene	77	10	0.015	14.6	1.54	0.079
Pentamethylbenzene	77	1	1.24	1.24	1.24	1.24
Pyridine	77	15	0.014	3.42	1.02	0.063
Safrole	77	1	0.065	0.065	0.065	0.065
Tripropyleneglycol Methyl Ether	77	11	0.447	1,550	386	30.1
Nonconventional Metal Pollutants						
Aluminum	86	76	0.076	134	14.3	3.58
Barium	86	85	0.019	32	2.06	0.186
Boron	86	85	0.191	686	37.6	6.39
Calcium	86	85	1.66	2,200	170	41.3
Cobalt	86	41	0.008	1.22	0.212	0.102
Gold	1	1	2.81	2.81	2.81	2.81
Iron	86	84	0.604	940	52.7	11.0
Magnesium	86	84	0.180	255	38.3	11.9
Manganese	86	84	0.031	29	1.90	0.373
Molybdenum	86	66	0.003	40.3	1.50	0.098
Sodium	86	85	27.1	2,030	442	210
Tin	86	55	0.003	85.2	3.22	0.058
Titanium	86	64	0.003	1.80	0.194	0.079
Vanadium	86	43	0.004	0.482	0.060	0.025
Yttrium	86	24	0.001	1.00	0.091	0.013
Other Nonconventional Pollutants						
Ammonia as Nitrogen	11	11	0.290	160	44.5	24.4
Chemical Oxygen Demand (COD)	85	85	30	213,000	24,961	5,750
Chloride	7	7	22	450	110	37.0
Fluoride	12	12	0.500	17	2.94	0.975
Hexavalent Chromium	71	14	0.010	1.74	0.195	0.021
Sulfate	35	34	16	176,000	15,585	430
Total Alkalinity	6	6	180	4,900	1,498	210
Total Dissolved Solids	82	82	272	88,800	9,930	2,600
Total Kjeldahl Nitrogen	11	11	0.840	1,500	302	8.86

Table 5-10 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Other Nonconventional Pollutants (continued)						
Total Organic Carbon (TOC)	70	68	7.66	106,000	7,028	1,230
Total Petroleum Hydrocarbon (As SGT-HEM)	74	68	5.07	25,431	2,213	511
Total Phosphorus	20	20	0.160	240	38.2	17.0
Total Recoverable Phenolics	84	81	0.005	1,360	59.3	0.220
Total Sulfide	23	20	3.00	18.0	7.85	7.00

Source: MP&M sampling program.

5.4 Chelated Metal-Bearing Wastewater

Chelated metal-bearing wastewater contains elevated concentrations of metals, typically copper or nickel. Sections 5.4.1 and 5.4.2 discuss chelated metal-bearing wastewater generated from MP&M unit operations and as influent to chelation-breaking wastewater treatment units, respectively.

5.4.1 Unit Operations Generating Chelated Metal-Bearing Wastewater

Electroless plating operations and rinses are the most common MP&M operations that generate chelated metal-bearing wastewater. Some cleaning operations also generate chelated metal-bearing wastewater. MP&M facilities use chelating agents in these unit operations to prevent metals from precipitating out of solution in the process bath.

During the MP&M sampling program, EPA collected samples of electroless nickel plating solutions and rinses that generate chelated metal-bearing wastewater. The maximum concentration of nickel detected in wastewater from the unit operations was 7,530 mg/L, while the maximum concentration of nickel in the wastewater from rinses was 378 mg/L. Other metals typically plated using electroless plating include copper, gold, palladium, and cobalt. EPA expects the concentrations of the plated metals in these solutions and associated rinses to be similar to the concentrations measured for nickel during the MP&M sampling program.

5.4.2 Chelation-Breaking Raw Wastewater Characteristics

Typical chemical precipitation and sedimentation treatment units do not effectively remove chelated metals; therefore, chelated metal-bearing wastewater typically requires segregation and preliminary treatment to break down the metal chelates before commingling with other metal-bearing waste streams for further treatment. If facilities do not segregate these streams from other metal-bearing waste streams, the chelated metal will not be efficiently removed. EPA detected copper concentrations ranging from 570 mg/L to 700 mg/L in influent samples from

preliminary treatment systems for electroless copper operations. EPA detected nickel at concentrations ranging from 0.149 mg/L to 480 mg/L in influent samples from preliminary treatment systems for electroless nickel operations. (See Section 10.0 for a discussion on achievable effluent concentrations of these chelated metals following chelation breaking/removal and chemical precipitation.)

Preliminary treatment may consist of chemical reduction using reducing agents such as sodium borohydride, hydrazine, dithiocarbamate (measured analytically as ziram) or sodium hydrosulfite; high-pH precipitation using calcium hydroxide or ferrous sulfate; or filtering the chelated metals out of solution. Section 8.2.4 describes typical metal chelation-bearing wastewater treatment technologies used in the MP&M industry.

5.5 General Metal-Bearing Wastewater

All MP&M unit operations can generate metal-bearing wastewater, including those wastewater streams described in the previous sections. Sections 5.5.1 and 5.5.2 discuss metal-bearing wastewater not previously discussed that is generated from MP&M unit operations and treated in chemical precipitation systems, respectively.

5.5.1 Unit Operations Generating General Metal-Bearing Wastewater

Table 5-11 summarizes the unit operations and associated rinses that generate general metal-bearing wastewater and the number of samples collected of each.

Table 5-11

Number of Process and Rinse Samples From Unit Operations That Generate General Metal-Bearing Wastewater

Unit Operation	No. of Process Samples	No. of Rinse Samples
Abrasive Blasting	3	3
Abrasive Jet Machining	1	0
Acid Treatment without Chromium	26	57
Adhesive Bonding	1	0
Alkaline Treatment without Cyanide	12	34
Anodizing without Chromium	4	4
Carbon Black Deposition	1	0
Chemical Milling	5	12
Chemical Conversion Coating without Chromium	19	42
Electrochemical Machining	1	2
Electroless Plating	6	15
Electroplating without Chromium or Cyanide	18	41
Electropolishing	1	1
Multiple Unit Operation Rinse	1	0
Photo Image Developing	5	11
Photo Resist Applications	1	3
Plasma Arc Machining	1	0
Salt Bath Descaling	1	3
Stripping (paint)	10	16
Stripping (metallic coating)	8	8
Welding	0	1
Wet Air Pollution Control (includes Acid/Alkaline and Fumes and Dust)	16	NA

Source: MP&M surveys and MP&M site visits.

NA - Not Applicable. No associated rinse.

Tables 5-12 and 5-13 summarize the analytical data collected during the MP&M sampling program for wastewater from unit operations and associated rinses, respectively, that generate general metal-bearing wastewater. As shown in these tables, the priority metal pollutants most commonly detected in samples of this wastewater were copper, zinc, chromium, nickel, and lead. Nonconventional metal pollutants frequently detected include iron, magnesium, boron, barium, manganese, and aluminum. Metal pollutants are typically present in unit operation process baths that apply or remove metal, such as electroplating or stripping process baths. EPA detected metal concentrations of up to 383,000 mg/L in unit operation process baths and up to 85,300 mg/L in unit operation rinses. This wastewater also typically contained oil and grease, total suspended solids, and low concentrations of organic pollutants.

Table 5-12

**Analytical Data from Unit Operations Generating
General Metal-Bearing Wastewater**

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,2,4-Trichlorobenzene	57	1	0.109	0.109	0.109	0.109
2,4-Dimethylphenol	54	3	0.049	0.167	0.091	0.056
2,4-Dinitrophenol	50	4	0.065	335	83.7	0.123
2,4-Dinitrotoluene	57	1	23.4	23.4	23.4	23.4
2,6-Dinitrotoluene	57	2	0.605	6.98	3.79	3.79
2-Nitrophenol	56	4	0.034	2.15	0.574	0.059
4,6-Dinitro-o-Cresol	53	3	0.037	0.065	0.047	0.039
4-Nitrophenol	54	4	0.101	14.1	3.63	0.153
Acrolein	57	1	0.591	0.591	0.591	0.591
Benzene	57	4	0.015	0.225	0.069	0.019
Bis(2-Ethylhexyl) Phthalate	57	15	0.012	18.2	2.54	0.326
Bromodichloromethane	57	2	0.017	0.017	0.017	0.017
Chlorobenzene	57	4	0.011	1.56	0.402	0.018
Chloroform	57	6	0.012	0.218	0.050	0.017
Chloromethane	57	1	0.101	0.101	0.101	0.101
Di-n-butyl Phthalate	57	1	0.105	0.105	0.105	0.105
Di-n-octyl Phthalate	57	2	0.639	1.42	1.03	1.03
Dibromochloromethane	57	2	0.013	0.015	0.014	0.014
Ethylbenzene	57	3	0.020	0.030	0.024	0.021
Fluorene	57	1	0.016	0.016	0.016	0.016
Methylene Chloride	57	4	0.010	0.173	0.062	0.033
n-Nitrosodi-n-Propylamine	56	1	0.841	0.841	0.841	0.841
n-Nitrosodimethylamine	57	1	6.67	6.67	6.67	6.67
Naphthalene	57	3	0.024	0.208	0.103	0.077
Nitrobenzene	57	1	0.119	0.119	0.119	0.119
Phenanthrene	57	1	0.037	0.037	0.037	0.037
Phenol	57	8	0.020	1,044	136	0.538
Pyrene	57	1	0.016	0.016	0.016	0.016
Toluene	57	2	0.014	0.047	0.031	0.031
Trichloroethene	56	8	0.010	2.29	0.310	0.024

Table 5-12 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Metal Pollutants						
Antimony	147	66	0.002	3.56	0.326	0.066
Arsenic	147	65	0.001	16.4	0.843	0.057
Beryllium	147	38	0.0005	3.87	0.300	0.034
Cadmium	147	74	0.002	57,100	900	0.148
Chromium	147	115	0.007	108,000	1,951	1.57
Copper	147	135	0.007	141,000	2,552	4.26
Cyanide	8	7	0.027	4.30	0.751	0.143
Lead	147	79	0.010	7,150	178	2.48
Mercury	147	31	0.000	0.032	0.003	0.0008
Nickel	147	111	0.007	84,623	2,837	3.18
Selenium	147	36	0.001	8.00	0.551	0.036
Silver	147	50	0.004	14.4	0.572	0.097
Thallium	147	21	0.001	2.83	0.196	0.021
Zinc	146	133	0.005	53,200	1,121	2.84
Conventional Pollutants						
BOD 5-Day (Carbonaceous)	49	34	4.29	60,400	6,596	1,625
Oil And Grease	79	54	0.315	260	19.4	4.70
Oil And Grease (As HEM)	51	23	6.39	1,140	208	82.0
pH	56	56	0.010	14.4	7.50	8.53
Total Suspended Solids	143	124	5.00	110,000	1,742	115
Nonconventional Organic Pollutants						
1,2:3,4-Diepoxybutane	57	1	0.251	0.251	0.251	0.251
1,4-Dinitrobenzene	57	2	1.07	2.96	2.02	2.02
1,4-Dioxane	57	4	0.304	2.80	1.10	0.643
1-Bromo-2-Chlorobenzene	57	5	0.012	0.978	0.317	0.057
1-Bromo-3-Chlorobenzene	57	4	0.031	0.490	0.193	0.126
1-Methylfluorene	57	1	0.035	0.035	0.035	0.035
1-Methylphenanthrene	57	1	0.027	0.027	0.027	0.027
2-Butanone	57	15	0.070	26.1	3.84	1.05
2-Hexanone	57	1	5.02	5.02	5.02	5.02
2-Methylnaphthalene	57	2	0.067	0.220	0.143	0.143
2-Propanone	57	32	0.052	250	10.4	0.465
3,6-Dimethylphenanthrene	57	1	0.013	0.013	0.013	0.013
4-Methyl-2-Pentanone	57	8	0.052	2.78	0.565	0.128

Table 5-12 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Organic Pollutants (continued)						
Alpha-Terpineol	56	1	1.40	1.40	1.40	1.40
Aniline	57	6	0.015	3.27	0.728	0.225
Benzoic Acid	57	11	0.051	8,098	754	1.109
Benzyl Alcohol	57	4	0.012	0.393	0.195	0.189
Carbon Disulfide	57	1	0.053	0.053	0.053	0.053
Dibenzofuran	57	1	0.140	0.140	0.140	0.140
Dibenzothiophene	57	1	0.011	0.011	0.011	0.011
Diphenylamine	57	1	0.032	0.032	0.032	0.032
Hexanoic Acid	57	6	0.012	31.5	9.08	5.02
Isobutyl Alcohol	57	1	0.012	0.012	0.012	0.012
m+p Xylene	42	1	0.059	0.059	0.059	0.059
m-Xylene	15	2	0.018	0.020	0.019	0.019
Methyl Methacrylate	57	5	0.012	0.797	0.471	0.586
n,n-Dimethylformamide	57	2	0.032	0.123	0.078	0.078
n-Decane	57	3	0.083	3.51	1.32	0.360
n-Docosane	57	2	0.021	0.051	0.036	0.036
n-Dodecane	57	2	0.024	1.27	0.648	0.648
n-Eicosane	57	2	0.020	0.956	0.488	0.488
n-Hexadecane	57	1	0.200	0.200	0.200	0.200
n-Nitrosomethylphenylamine	57	1	1.36	1.36	1.36	1.36
n-Nitrosomorpholine	57	1	0.040	0.040	0.040	0.040
n-Octadecane	57	1	0.132	0.132	0.132	0.132
n-Tetracosane	57	1	0.055	0.055	0.055	0.055
n-Tetradecane	57	2	0.044	0.114	0.079	0.079
o+p Xylene	15	2	0.010	0.910	0.460	0.460
o-Cresol	57	3	0.023	0.195	0.085	0.039
o-Toluidine	57	1	0.030	0.030	0.030	0.030
o-Xylene	42	1	0.048	0.048	0.048	0.048
p-Cresol	57	8	0.011	2.69	0.493	0.153
p-Nitroaniline	57	2	0.051	26.1	13.1	13.1
Resorcinol	57	2	1.24	4.12	2.68	2.68
Tripropyleneglycol Methyl Ether	57	7	0.245	100	33.5	20.1
Nonconventional Metal Pollutants						
Aluminum	147	116	0.027	34,900	1,283	3.84

Table 5-12 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Metal Pollutants (continued)						
Barium	147	122	0.001	259	3.60	0.088
Boron	147	122	0.017	17800	561	0.858
Calcium	147	143	0.146	1,936	78.3	23.9
Cobalt	147	79	0.003	4700	67.3	0.530
Gold	1	1	0.392	0.392	0.392	0.392
Iron	147	135	0.008	374,000	5,892	3.66
Magnesium	147	124	0.085	960	66.8	14.6
Manganese	147	119	0.001	20,600	265	0.319
Molybdenum	147	89	0.006	197	5.38	0.205
Sodium	147	145	1.25	383,000	16,367	534.0
Tin	147	71	0.006	22,670	1,090	1.88
Titanium	147	97	0.002	13,250	223	0.177
Vanadium	147	71	0.004	1,495	25.5	0.062
Yttrium	147	30	0.001	2.11	0.171	0.038
Other Nonconventional Pollutants						
Acidity	74	45	2.00	600,000	106,486	39,600
Ammonia As Nitrogen	70	52	0.145	43,000	2,269	16.0
Chemical Oxygen Demand (COD)	82	77	6.90	600,000	32,696	4,700
Chloride	79	62	1.00	328,300	14,478	80.0
Fluoride	79	66	0.140	55,500	1,653	3.50
Hexavalent Chromium	52	9	0.008	0.430	0.090	0.025
Sulfate	107	90	2.40	755,000	35,877	275
Total Alkalinity	74	48	2.00	890,000	75,352	435
Total Dissolved Solids	143	141	87	1,000,000	114,066	23,900
Total Kjeldahl Nitrogen	61	52	0.480	40,000	3,158	53.8
Total Organic Carbon (TOC)	50	49	3.70	54,000	10,076	1,380
Total Petroleum Hydrocarbons (As SGT-HEM)	51	9	8.88	352	90.2	25.2
Total Phosphorus	34	25	0.020	11,000	809	7.50
Total Recoverable Phenolics	73	53	0.006	135	5.48	0.140
Total Sulfide	2	1	3.00	3.00	3.00	3.00

Source: MP&M sampling program.

Table 5-13

**Analytical Data from Rinses Generating
General Metal-Bearing Wastewater**

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,2-Diphenylhydrazine	113	1	0.096	0.096	0.096	0.096
1,4-Dichlorobenzene	113	1	0.013	0.013	0.013	0.013
Bis(2-Ethylhexyl) Phthalate	113	7	0.011	0.281	0.106	0.053
Bromodichloromethane	113	29	0.010	0.030	0.018	0.018
Chloroform	113	62	0.010	0.081	0.025	0.022
Chloromethane	113	2	0.051	0.102	0.076	0.076
Di-n-butyl Phthalate	113	4	0.157	0.190	0.176	0.178
Di-n-octyl Phthalate	113	1	0.013	0.013	0.013	0.013
Dibromochloromethane	113	24	0.010	0.026	0.016	0.016
Diethyl Phthalate	113	1	0.049	0.049	0.049	0.049
Methylene Chloride	113	1	0.011	0.011	0.011	0.011
Phenol	112	9	0.010	2.00	0.264	0.022
Trichloroethene	113	6	0.010	0.021	0.016	0.017
Priority Metal Pollutants						
Antimony	253	41	0.002	0.116	0.026	0.009
Arsenic	253	65	0.001	0.312	0.019	0.009
Beryllium	253	18	0.001	0.059	0.010	0.002
Cadmium	253	58	0.002	8,053	139	0.009
Chromium	253	144	0.005	21.8	1.06	0.102
Copper	253	227	0.003	560	16.2	0.201
Cyanide	14	11	0.020	135	28.3	0.830
Lead	253	64	0.002	56.6	1.72	0.099
Mercury	253	23	0.000	0.004	0.001	0.00048
Nickel	253	162	0.005	2,620	45.1	0.136
Selenium	253	39	0.001	0.072	0.011	0.003
Silver	253	49	0.005	7.20	0.325	0.012
Thallium	253	20	0.001	0.039	0.007	0.002
Zinc	253	188	0.002	13,700	127	0.142
Conventional Pollutants						
BOD 5-day (Carbonaceous)	112	50	1.07	873	83.0	11.6

Table 5-13 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Conventional Pollutants (continued)						
Oil And Grease	86	59	0.295	91.0	9.36	3.80
Oil And Grease (As HEM)	117	28	6.23	800	58.3	10.9
pH	122	122	0.25	13.3	6.69	6.84
Total Suspended Solids	250	157	2.00	6,920	141	20.0
Nonconventional Organic Pollutants						
1,4-Dioxane	113	2	0.132	2.02	1.08	1.08
2-Butanone	113	12	0.066	0.550	0.195	0.124
2-Propanone	113	8	0.052	11.5	1.59	0.071
Benzoic Acid	113	4	0.126	4.31	1.63	1.05
Benzyl Alcohol	113	2	0.014	0.014	0.014	0.014
Carbon Disulfide	113	2	0.062	0.354	0.208	0.208
Dibenzofuran	113	1	0.010	0.010	0.010	0.010
Hexanoic Acid	113	3	0.013	0.332	0.147	0.096
n,n-dimethylformamide	113	5	0.025	0.115	0.045	0.028
n-decane	113	1	0.012	0.012	0.012	0.012
n-docosane	113	1	0.012	0.012	0.012	0.012
n-nitrosopiperidine	113	1	0.020	0.020	0.020	0.020
o-anisidine	113	1	0.025	0.025	0.025	0.025
p-cresol	113	6	0.014	0.063	0.038	0.040
Pentamethylbenzene	113	1	0.036	0.036	0.036	0.036
Safrole	113	1	0.085	0.085	0.085	0.085
Thianaphthene	113	1	0.010	0.010	0.010	0.010
Toluene, 2,4-Diamino-	113	1	6.56	6.56	6.56	6.56
Tripropyleneglycol Methyl Ether	113	1	8.48	8.48	8.48	8.48
Nonconventional Metal Pollutants						
Aluminum	253	182	0.022	321	5.85	0.214
Barium	253	208	0.0007	2.90	0.065	0.036
Boron	253	187	0.012	363	5.34	0.193
Calcium	253	245	0.033	361	32.9	23.9
Cobalt	253	53	0.003	11.0	0.744	0.032
Iron	253	193	0.003	2,810	40.1	0.323
Magnesium	253	229	0.078	130	10.4	8.59
Manganese	253	163	0.001	135	3.33	0.027
Molybdenum	253	68	0.003	13.4	0.414	0.022

Table 5-13 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Metal Pollutants (continued)						
Sodium	253	249	0.277	85,300	1,179	63.3
Tin	253	73	0.005	6,070	103	0.067
Titanium	253	90	0.002	18.1	0.879	0.014
Vanadium	253	31	0.004	1.10	0.142	0.016
Yttrium	253	15	0.001	0.870	0.066	0.003
Other Nonconventional Pollutants						
Acidity	77	50	1.00	90,100	3,397	115
Amenable Cyanide	5	5	0.830	135	60.7	61.5
Ammonia as Nitrogen	104	51	0.100	729	29.9	2.39
Chemical Oxygen Demand (COD)	140	113	5.20	73,000	1,041	49.0
Chloride	84	83	1.20	20,000	452	30.0
Fluoride	85	71	0.180	60.0	3.58	1.00
Hexavalent Chromium	117	22	0.011	0.590	0.054	0.020
Sulfate	149	143	2.33	28,400	534	58.8
Total Alkalinity	75	57	8.00	8,600	507	72.0
Total Dissolved Solids	250	250	20.0	260,000	3,799	629
Total Kjeldahl Nitrogen	102	56	0.10	6,720	151	8.07
Total Organic Carbon (TOC)	112	101	1.16	5,800	195	10.7
Total Petroleum Hydrocarbons (As SGT-HEM)	117	13	5.25	316	43.3	9.52
Total Phosphorus	36	26	0.026	720	54.0	6.65
Total Recoverable Phenolics	132	53	0.005	2.85	0.083	0.012
Weak-acid Dissociable Cyanide	3	3	52.9	140	108	131

Source: MP&M sampling data.

5.5.2 General Metal-Bearing Raw Wastewater Characteristics

Typically, MP&M facilities with well-designed treatment systems segregate their waste streams by type and treat them in preliminary treatment units designed to treat the particular characteristic as discussed in Sections 5.1 through 5.4. After preliminary treatment, MP&M facilities typically commingle the wastewater with general process wastewater generated from the unit operations described in Section 5.5.1 and treat it in an end-of-pipe treatment system. Generally, the end-of-pipe treatment consists of chemical precipitation and sedimentation. Where high concentrations of metals are present in the wastewater, facilities may employ preliminary batch chemical precipitation and sedimentation to ensure that the high concentrations will not

cause a process upset to the end-of-pipe treatment system. Section 8.2.2 discusses metal-bearing wastewater treatment technologies used in the MP&M industry. Table 5-14 summarizes the data obtained from sampling the influent to end-of-pipe chemical precipitation systems. (See Section 10.0 for a discussion of achievable effluent concentrations following chemical precipitation.)

Table 5-14

**Analytical Data for General Metal-Bearing Treatment
Influent Wastewater Streams**

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Priority Organic Pollutants						
1,1,1-Trichloroethane	137	6	0.019	0.084	0.053	0.053
1,1,2,2-Tetrachloroethane	137	1	12.1	12.1	12.1	12.1
1,1-Dichloroethene	137	2	0.011	0.748	0.379	0.379
4-Chloro-3-Methylphenol	136	9	0.011	1.14	0.183	0.076
Anthracene	137	1	0.104	0.104	0.104	0.104
Benzene	137	1	0.025	0.025	0.025	0.025
Bis(2-Chloroethyl) Ether	137	1	0.016	0.016	0.016	0.016
Bis(2-Ethylhexyl) Phthalate	137	20	0.008	0.298	0.051	0.014
Bromodichloromethane	137	14	0.011	0.143	0.026	0.016
Butyl Benzyl Phthalate	137	2	0.009	0.010	0.009	0.009
Chloroform	137	63	0.010	0.824	0.102	0.032
Chloromethane	137	1	0.011	0.011	0.011	0.011
Di-n-butyl Phthalate	137	3	0.007	0.066	0.044	0.058
Di-n-octyl Phthalate	137	1	0.012	0.012	0.012	0.012
Dibromochloromethane	137	6	0.014	0.065	0.024	0.016
Diethyl Phthalate	134	1	0.038	0.038	0.038	0.038
Ethylbenzene	137	5	0.006	0.335	0.074	0.010
Fluorene	137	1	0.045	0.045	0.045	0.045
Methylene Chloride	137	10	0.008	0.172	0.043	0.023
Naphthalene	137	3	0.012	0.054	0.035	0.038
Phenanthrene	137	3	0.041	0.112	0.071	0.060
Phenol	139	19	0.016	0.634	0.099	0.029
Tetrachloroethene	137	8	0.015	1.11	0.306	0.081
Toluene	137	6	0.009	2.77	0.533	0.019
Trichloroethene	137	3	0.019	0.023	0.021	0.021
Priority Metal Pollutants						
Antimony	219	77	0.002	1.13	0.062	0.019
Arsenic	223	88	0.001	0.530	0.026	0.009
Beryllium	223	62	0.0002	3.23	0.235	0.004
Cadmium	223	113	0.001	323	6.26	0.065

Table 5-14 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)				
			Minimum	Maximum	Mean	Median	
Priority Metal Pollutants (continued)							
Chromium	223	213	0.012	1,350	15.1	1.27	
Copper	223	221	0.013	344	16.3	1.08	
Lead	223	149	0.002	159	3.44	0.176	
Mercury	221	48	0.00003	0.012	0.0009	0.0003	
Nickel	223	215	0.012	2,101	30.5	1.52	
Selenium	219	35	0.001	0.090	0.019	0.007	
Silver	223	134	0.005	4.23	0.401	0.046	
Thallium	219	24	0.001	0.112	0.011	0.002	
Zinc	223	212	0.009	1,540	17.8	0.945	
Conventional Pollutants							
BOD 5-Day (Carbonaceous)	133	86	2.40	609	64.4	26.0	
Oil And Grease (as HEM)	205	133	0.570	32,000	507	11.9	
Total Suspended Solids	222	202	4.00	8,920	569	96.8	
Nonconventional Organic Pollutants							
1 4-Dioxane	132	2	0.033	0.118	0.0755	0.0755	
1-Methylfluorene	132	2	0.111	0.189	0.150	0.150	
1-Methylphenanthrene	132	2	0.092	0.181	0.136	0.136	
2-Butanone	132	8	0.056	2.45	0.481	0.079	
2-Methylnaphthalene	132	2	0.076	0.205	0.140	0.140	
2-Propanone	132	74	0.051	16.7	0.952	0.151	
3,6-Dimethylphenanthrene	132	2	0.019	0.062	0.041	0.041	
4-Methyl-2-Pentanone	132	10	0.120	1.36	0.308	0.181	
Acetophenone	132	1	0.073	0.073	0.073	0.073	
Alpha-Terpineol	132	5	0.013	0.087	0.051	0.054	
Aniline	132	1	0.013	0.013	0.013	0.013	
Benzoic Acid	132	45	0.053	46.8	1.38	0.224	
Benzyl Alcohol	132	8	0.011	0.145	0.039	0.015	
Beta-Naphthylamine	130	1	0.104	0.104	0.104	0.104	
Biphenyl	132	1	0.011	0.011	0.011	0.011	
Carbon Disulfide	132	10	0.016	3.92	0.505	0.058	
Dibenzothiophene	132	2	0.015	0.025	0.020	0.020	
Diphenylamine	132	1	0.033	0.033	0.033	0.033	
Hexanoic Acid	132	21	0.010	0.461	0.056	0.017	
m-xylene	71	1	0.016	0.016	0.016	0.016	

Table 5-14 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Organic Pollutants (continued)						
Methyl Methacrylate	132	1	0.019	0.019	0.019	0.019
n,n-dimethylformamide	132	8	0.012	0.581	0.093	0.016
n-decane	132	1	0.031	0.031	0.031	0.031
n-docosane	132	2	0.013	0.026	0.019	0.019
n-dodecane	132	7	0.044	0.772	0.243	0.088
n-eicosane	132	9	0.014	0.181	0.043	0.020
n-hexacosane	132	6	0.022	0.037	0.033	0.034
n-hexadecane	132	13	0.010	0.631	0.127	0.061
n-nitrosomethylethylamine	132	2	0.019	0.023	0.021	0.021
n-nitrosomorpholine	132	2	0.011	0.028	0.020	0.020
n-octacosane	132	2	0.035	0.036	0.036	0.036
n-octadecane	132	19	0.011	0.493	0.090	0.027
n-tetracosane	132	4	0.012	0.021	0.017	0.018
n-tetradecane	132	10	0.017	1.01	0.227	0.104
n-triacontane	132	2	0.015	0.031	0.023	0.023
o+p-xylene	71	3	0.013	0.023	0.017	0.014
o-toluidine	132	1	0.013	0.013	0.013	0.013
p-chloroaniline	132	1	0.098	0.098	0.098	0.098
p-cresol	132	10	0.013	0.030	0.019	0.017
p-cymene	132	3	0.015	0.054	0.030	0.020
Styrene	132	5	0.013	0.188	0.057	0.025
Trichlorofluoromethane	137	7	0.025	0.109	0.042	0.032
Tripropyleneglycol Methyl Ether	132	23	0.064	5.21	1.83	1.05
Nonconventional Metal Pollutants						
Aluminum	223	212	0.055	571	11.1	2.85
Barium	223	198	0.010	9.91	0.201	0.069
Boron	212	198	0.057	206	4.14	0.746
Calcium	223	223	4.77	832	74.1	37.8
Cobalt	223	95	0.002	25.8	0.924	0.021
Gold	20	10	0.013	0.150	0.056	0.038
Iron	223	223	0.061	3,880	102	4.96
Magnesium	223	218	0.349	3,360	88.7	10.3
Manganese	223	222	0.004	47.3	1.47	0.2315
Molybdenum	223	149	0.003	3.06	0.253	0.039

Table 5-14 (Continued)

Pollutant Parameter	No. of Samples Analyzed	No. of Detects	Concentrations (mg/L)			
			Minimum	Maximum	Mean	Median
Nonconventional Metal Pollutants (continued)						
Palladium	10	8	0.053	0.229	0.114	0.085
Sodium	223	223	20.1	9,600	471	216
Tin	212	137	0.004	75.3	4.85	0.189
Titanium	212	155	0.002	76.4	1.85	0.052
Vanadium	223	58	0.0016	1.19	0.067	0.014
Yttrium	212	57	0.00084	0.085	0.010	0.003
Other Nonconventional Pollutants						
Acidity	73	54	7.00	24,770	1,862	140
Amenable Cyanide	7	5	0.012	0.129	0.085	0.092
Ammonia As Nitrogen	91	88	0.040	320	19.3	2.56
Chemical Oxygen Demand (COD)	205	196	1.50	13,000	541	122
Chloride	80	77	4.50	9,500	410	140
Fluoride	80	79	0.130	100	4.49	1.55
Hexavalent Chromium	133	50	0.010	21.0	0.771	0.060
Sulfate	136	130	18.0	19,000	586	268
Total Alkalinity	74	47	2.39	510	126	96.0
Total Dissolved Solids	222	222	19.0	34,000	2,426	1,030
Total Kjeldahl Nitrogen	85	82	0.110	160	14.9	6.69
Total Organic Carbon (TOC)	128	99	3.57	394	59.9	32.3
Total Petroleum Hydrocarbon (As SGT-HEM)	133	49	5.00	93.0	21.2	10.3
Total Phosphorus	86	84	0.020	525	30.3	5.2
Total Recoverable Phenolics	189	110	0.006	13.0	0.387	0.047
Total Sulfide	28	2	2.00	4.00	3.00	3.00

Source: MP&M sampling program.

6.0 INDUSTRY SUBCATEGORIZATION

This section discusses the subcategorization of the MP&M Point Source Category. Section 6.1 discusses the methodology and factors considered when determining the subcategories and Section 6.2 describes facilities in each subcategory.

6.1 Methodology and Factors Considered for Basis of Subcategorization

To provide a method for addressing variations between products, raw materials processed, and other factors that result in distinctly different effluent characteristics, EPA divided the MP&M Point Source Category into groupings called “subcategories.” Each subcategory has a uniform set of effluent limitations that take into account technological achievability and economic impacts unique to that subcategory. The Clean Water Act (CWA) requires EPA, in developing effluent limitations guidelines and pretreatment standards, to consider a number of different subcategorization factors. The statute also authorizes EPA to take into account other factors the Agency deems appropriate. EPA considered the following factors in its evaluation of potential MP&M subcategories:

- C Unit operation;
- C Activity;
- C Raw materials;
- C Products;
- C Size of site;
- C Geographic location;
- C Facility age;
- C Nature of the waste generated;
- C Economic impacts;
- C Treatment costs;
- C Total energy requirements;
- C Air pollution control methods;
- C Solid waste generation and disposal; and
- C Publicly Owned Treatment Works (POTW) burden.

As a result, EPA has determined that a basis exists for dividing the MP&M category into the following subcategories for the proposed rule, as shown in Table 6-1.

Table 6-1**Proposed Subcategories**

Facilities that Generate Metal-Bearing Wastewater (With or Without Oil-Bearing Wastewater)	Facilities that Generate Only Oil-Bearing Wastewater
General Metals	Oily Wastes
Metal Finishing Job Shops	Railroad Line Maintenance
Non-Chromium Anodizing	Shipbuilding Dry Dock
Printed Wiring Board	
Steel Forming and Finishing	

6.1.1 Factors Contributing to Subcategorization

EPA found two basic types of waste streams in the industry: 1) wastewater with high metals content (metal-bearing), and 2) wastewater with low concentration of metals, and high oil and grease content (oil-bearing). The type of wastewater a facility generates is directly related to the unit operations it performs. For example, unit operations such as machining, grinding, aqueous degreasing, and impact or pressure deformation tend to generate a wastewater with high oil and grease (and associated organic pollutants) loadings but relatively lower concentrations of metal pollutants. Other unit operations such as electroplating, conversion coating, chemical etching and milling, and anodizing generate higher metals loadings with moderate or low oil and grease concentrations or generate wastewater containing both metals and oil and grease.

Although many facilities generate both metal- and oil-bearing wastewater, a large number of facilities, typically machine shops and maintenance and repair facilities, only generate oil-bearing wastewater. Since the wastewater at these facilities primarily contains oil and grease and other organic constituents, these facilities use treatment technologies that focus on oil removal only and do not include the chemical precipitation step needed to treat metal-bearing wastewater. These treatment technologies generally include ultrafiltration, or chemical emulsion breaking followed by either gravity flotation, coalescing plate oil/water separators, or dissolved air flotation (DAF). Therefore, EPA first divided the industry on the basis of unit operations performed and the nature of the wastewater generated, resulting in the following two groups: (1) metal-bearing with or without oily and organic constituents group; and (2) oil-bearing only group. EPA then performed an analysis to identify any significant differences in the subcategorization factors within the two basic groups. Section 6.2.6 identifies the unit operations that EPA believes to generate only oil-bearing wastewater to generate metal-bearing wastewater. EPA considers MP&M facilities that perform MP&M unit operations other than those mentioned in Section 6.2.6 to generate metal-bearing wastewater.

Metal-Bearing Wastewater (With or Without Oil-Bearing Wastewater)

When looking at facilities generating metal-bearing wastewater (with or without oil-bearing wastewater), EPA identified five groups of facilities that could potentially be subcategorized by dominant product, raw materials used, and/or nature of the waste generated. In two groups, EPA also considered economic impacts as a factor in subcategorization because of the reduced ability of these facilities to afford treatment costs. Within the group of facilities with metal bearing wastewater EPA also identified one group where the number of facilities not currently covered by an existing effluent guidelines regulation was large enough to present an unacceptable burden to POTWs.

Based on the currently available data, EPA divided the metal-bearing (with or without oil-bearing wastewater) MP&M facilities into the following subcategories: non-chromium anodizing facilities; metal finishing job shops; printed wiring board facilities; steel forming and finishing facilities; and general metals facilities. EPA describes its rationale for subcategorizing each of these groups below (see Section 6.2 for additional detailed discussion and applicability).

The non-chromium anodizers differ from other MP&M facilities in that all of their products are primarily of one metal type, anodized aluminum, and most importantly, they do not use chromic acid, dichromate sealants, or other process solutions containing significant concentrations of chromium in their anodizing process. Based on EPA's limited data for these facilities, the Agency expects that these facilities have very low levels of metals (with the exception of aluminum) or toxic organic pollutants in their wastewater discharges. EPA determined that other MP&M facilities had much greater concentrations of a wider variety of metals. Table 6-2 illustrates this point by providing the percentage of facilities using multiple metal types by subcategory.

Table 6-2**Percentage of Facilities Using Multiple Metal Types by Subcategory**

Proposed Subcategory	Number of Metal Types Processed						
	0	1	2	3	4	5-10	
Shipbuilding Dry Docks	0	0	25	50	0	25	0
General Metals	0	51	23	13	4	10	0
Steel Forming and Finishing	0	55	25	14	3	3	0
Metal Finishing Job Shop	0	7	24	23	4	41	1
Non-Chromium Anodizer	0	76	24	0	0	0	0
Oily Wastes	32	13	53	1	<1	0	0
Printed Wiring Boards	0	1	0	49	9	40	1
Railroad Line Maintenance	<1	98	1	<1	0	0	0

Source: MP&M Survey Database

In addition, non-chromium anodizing facilities require much larger wastewater treatment systems than other metal-bearing MP&M facilities to remove the large amounts of aluminum and low levels of alloy metals generated in their wastewater. The need for larger treatment systems results in higher costs and large economic impacts for this proposed subcategory. EPA found that as many as 60 percent of the non-chromium anodizers could close as a result of complying with the regulatory options considered.

Therefore, based on the difference in raw materials used, product produced, nature of the waste generated (i.e., low levels of pollutants discharged), treatment costs, and projected economic impacts, EPA concluded that a basis exists for subcategorizing the non-chromium anodizing facilities in the MP&M industry.

EPA investigated whether to subcategorize the metal finishing and electroplating job shops covered currently by the metal finishing (40 CFR 433) and electroplating (40 CFR 413) effluent guidelines. Although these facilities have metal types that require the same treatment technologies as many other metal-bearing facilities, EPA determined that they can be different due to the variability of their raw materials and products as well as the slightly higher economic impacts incurred as compared to other MP&M facilities. As discussed in Section 6.2, this subcategory includes only those facilities that perform the six operations defining the applicability of the metal finishing and electroplating effluent guidelines and that are “job shops” as defined in the metal finishing effluent guidelines (i.e., they own less than 50 percent of the products processed on site on an annual area basis).

Because these facilities are job shops and work on a contract basis, they cannot always predict the type of plating or other finishing operations required. In addition, because these facilities work on a large variety of metal types from various customers, their wastewater characteristics can vary from week to week (or even day to day). Table 6-2 demonstrates the variety of metal types processed at metal finishing job shops as compared to the rest of the industry. (Note that shipbuilding dry docks and printed wiring board facilities also process a wide variety of metal types. EPA also chose to subcategorize these groups for reasons discussed below.) EPA performed sampling to specifically identify the variability in the wastewater generated at metal finishing job shops, and found that the variability factors calculated solely on the analytical wastewater sampling data from metal finishing and electroplating job shops are higher for most pollutant parameters than those calculated for similar metal-bearing subcategories (e.g., General Metals) (see Section 10.1 for a discussion of EPA's job shop variability wastewater sampling and Section 10.3 for a discussion on determining limits and variability factors). In addition, EPA found that up to 10 percent of the indirect discharging metal finishing job shops could close as a result of compliance with the proposed regulation. Therefore, EPA concluded that it has an appropriate basis for subcategorizing metal finishing and electroplating job shops.

EPA determined that there is a basis for subcategorizing the printed wiring board facilities based on raw materials, unit operations performed, primary product, and nature of the waste generated. First, as shown in Table 6-3, these facilities process a more consistent mix of metal types (primarily copper, tin, and lead) than other metal-bearing wastewater generating MP&M facilities. EPA concluded that this consistent mix of metal types enables printed wiring board facilities to tailor their treatment technology and incorporate more of the advanced pollution prevention and recovery technologies (e.g., ion exchange).

Table 6-3**Percentage of MP&M Facilities by Subcategory Using Each Metal Type**

Metal	Subcategory							
	Shipbuilding Dry Docks	General Metals	Steel Forming and Finishing	Metal Finishing Job Shop	Non- Chromium Anodizer	Oily Wastes	Printed Wiring Boards	Railroad Line Maintenance
Aluminum	25	38	3	60	88	46	6	1
Beryllium	0	0	0	1	0	0	0	0
Cadmium	25	1	3	11	0	0	0	0
Chromium	50	6	11	27	0	1	3	0
Cobalt	0	3	3	0	0	1	1	0
Copper	75	28	10	53	0	12	99	6
Gold	0	4	0	14	0	0	82	0
Indium	0	0	0	0	0	0	0	0
Iron	100	82	100	87	36	86	11	100
Lead	0	4	1	9	0	1	94	6
Magnesium	0	2	0	5	0	2	0	0
Manganese	0	0	0	0	0	0	2	0
Molybdenum	25	0	0	0	0	0	6	0
Nickel	75	13	5	53	0	6	82	0
Palladium	0	1	0	0	0	0	7	0
Platinum	0	0	0	1	0	0	0	0
Rhodium	0	0	0	6	0	0	1	0
Ruthenium	0	0	0	0	0	0	1	0
Selenium	0	0	0	0	0	0	0	0
Silver	25	2	0	16	0	0	11	0
Tantalum	0	1	0	0	0	0	0	0
Tin	0	11	5	30	0	0	97	0
Titanium	0	3	3	3	0	1	0	0
Tungsten	0	1	0	0	0	1	0	0
Yttrium	0	0	0	1	0	0	8	0
Zinc	25	14	30	54	0	1	3	0
Zirconium	0	0	0	0	0	0	0	0

Source: MP&M Survey Database

Printed wiring board facilities generally work with copper-clad laminate material, allowing them to target copper for removal in their wastewater treatment systems or recover the copper using in-process ion exchange. Second, these facilities apply, develop, and strip photo resist - a set of unit operations that is unique to this subcategory. This process produces a higher concentration of a more consistent group of organic constituents than other facilities in the metal-bearing group. Finally, the nature of the wastewater generated at these facilities may also be different because these facilities perform more lead-bearing operations (e.g., lead/tin electroplating, wave soldering) than other MP&M facilities.

Steel forming and finishing is another proposed subcategory under the metal-bearing group of MP&M facilities. These facilities perform both cold forming and finishing operations on steel at stand-alone facilities as well as at steel manufacturing facilities. EPA formerly covered these facilities under the 1982 Iron and Steel Manufacturing effluent guidelines (40 CFR Part 420). Typical operations include: acid pickling, annealing, conversion coating (e.g., zinc phosphate, copper sulfate), hot dip coating and/or electroplating of steel wire or rod, heat treatment, welding, drawing, patenting, and oil tempering. EPA concluded that the basis for subcategorization is the difference in the raw material and primary product at these facilities. Facilities in this subcategory primarily process steel and, for the most part, produce uniformly shaped products such as wire, rod, bar, pipe, and tube. In addition, this is the only subcategory for which EPA is proposing to cover forming operations under the MP&M regulations. Effluent guidelines specific to forming operations exist for all other common metal types (e.g., Aluminum Forming (40 CFR Part 467); Copper Forming (40 CFR Part 468); and Nonferrous Metals Forming & Metal Powders (40 CFR Part 471)).

After subcategorizing non-chromium anodizing facilities, metal finishing job shops, printed wiring board facilities, and steel forming and finishing facilities, EPA is proposing to group the remaining metal-bearing wastewater generating MP&M facilities into a subcategory entitled “General Metals.” This subcategory would be a “catch-all” for metal-bearing wastewater generating facilities that do not fall into any of the previous subcategories. For example, wastewater generated from most manufacturing operations and heavy rebuilding operations (e.g., aircraft, aerospace, auto, bus/truck, railroad) would be regulated under the proposed General Metals subcategory. Whereas all facilities in the other four metal-bearing subcategories are currently covered by existing effluent guidelines, only 16 percent of General Metals facilities are covered by 433/413 (with another 10 percent having some waste streams covered by other metals, effluent guidelines). This means that over 25,000 MP&M facilities in this subcategory would require new permits (i.e. control mechanisms). EPA recognizes that this would create a very large burden on POTWs. Therefore, in determining a proposed option for the General Metals Subcategory, EPA considered the POTW permitting burden associated with proposing pretreatment standards for over 25,000 facilities (See Section 14.0).

Oil-Bearing Only Group

When evaluating facilities with only oil-bearing wastewater for potential further subcategorization, EPA identified two types of facilities that were different from the other facilities in

that group based on size, location, and dominant product or activity. The first type of facility is railroad line maintenance facilities, and the second performs MP&M operations in shipbuilding dry docks or similar structures (see Section 6.2.7 and 6.2.8, respectively, for detailed descriptions of these proposed subcategories).

Railroad line maintenance facilities perform outdoor light maintenance and cleaning of railroad cars, engines, and wheel trucks. EPA concluded that there is a basis to subcategorize railroad line maintenance facilities due to their outdoor location, unit operations performed, and low level of pollutant loadings discharged to the environment. Unit operations typically performed at railroad line maintenance facilities include: abrasive blasting, alkaline cleaning for oil removal, aqueous degreasing, assembly/disassembly, floor cleaning, washing finished products, welding, and collection of storm water. EPA notes that this proposed subcategory does not include railroad manufacturing facilities or railroad overhaul/rebuilding facilities.

The second type of facility is dry docks (and similar structures such as graving docks, building ways, lift barges, and marine railways): large, outdoor areas, exposed to precipitation, where shipyards perform final assembly, maintenance, rebuilding, and repair work on large ships and boats. EPA believes that a basis exists to subcategorize shipbuilding dry docks and similar structures due to their size, outdoor location, low level of pollutant loadings discharged to the environment, and the fact this wastewater is unique to the shipbuilding industry. This proposed subcategory does not include other MP&M operations that occur at shipyards (e.g., shore-side operations).

The facilities that generate only oil-bearing wastewater but are not dry docks or railroad line maintenance facilities fall into the Oily Wastes Subcategory. These facilities discharge only oil-bearing wastewater and perform only one or more of the unit operations listed in Table 6-4 below.

Table 6-4

Unit Operations Performed by Oily Wastes Facilities

Alkaline Cleaning for Oil Removal	Machining
Aqueous Degreasing	Pressure Deformation
Corrosion Preventive Coating	Solvent Degreasing
Floor Cleaning	Testing (e.g., Hydrostatic, Dye Penetrant, Ultrasonic, Magnetic Flux)
Grinding	Painting
Heat Treating	Steam Cleaning
Impact Deformation	Laundering

Therefore, EPA divided the facilities in the MP&M industry that generate only oil-bearing wastewater into the following three subcategories: (1) railroad line maintenance facilities; and (2) shipbuilding dry docks (and similar structures); (3) oily waste facilities. Following further analysis, EPA decided not to propose pretreatment standards for indirect dischargers in the railroad line maintenance and shipbuilding dry dock subcategories and proposed a low flow cutoff of 2 million gallons per year for indirect dischargers in the Oily Wastes Subcategory. (see Section 14.8 for a discussion pertaining to pretreatment standards).

6.1.2 Factors That are not a Basis for MP&M Subcategorization

EPA examined the other factors listed earlier in this section for possible basis of subcategorization. The Agency determined that there is no basis for subcategorizing the MP&M industry based on the following factors: geographic location, age of facilities, total energy requirements, air pollution control methods, and solid waste generation and disposal. These factors are discussed below. In addition, EPA also considered subcategorizing the MP&M industry according to the 18 industrial sectors listed in Section 2.2.5. As discussed in Section 6.1.1, and further discussed below, EPA determined that subcategorization based on sectors was appropriate for only one sector (printed wiring board), and for portions of three other sectors (railroad, ships and boats, and job shops).

Geographic Location

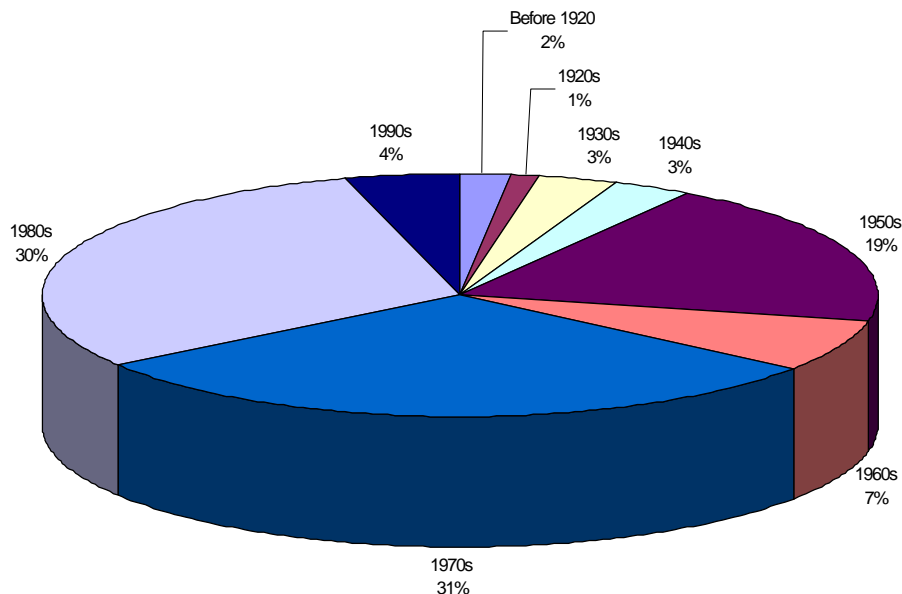
MP&M sites are located throughout the United States. Sites are not limited to any one geographical location, but approximately half are located east of the Mississippi, with additional concentrations of sites in Texas, Colorado, and California. EPA did not subcategorize based on geographic location because location does not affect the ability of sites to comply with the MP&M rule.

Geographic location may impact costs if additional land is required to install treatment systems, since the cost of the land will vary depending on whether the site is located in an urban or rural location. However, the treatment systems used to treat MP&M wastewater typically do not have large land requirements, as demonstrated by the fact that many MP&M sites are located in urban settings.

Water availability is another function of geographical location. Limited water supply encourages efficient use of water. The Agency encourages installing water recycle and reuse practices. The proposed treatment options for all subcategories include pollution prevention and water conservation because these practices tend to reduce treatment costs and improve pollutant removals.

Facility Age

The percentage of water-discharging facilities by the decade in which they were built is shown in Figure 6-1. This information is based upon responses to MP&M surveys that reported the date the facility was built.



Source: MP&M Survey Database.

Note: MP&M surveys were mailed in 1991 and 1996. There are 62,749 wastewater-discharging MP&M sites.

Figure 6-1. Percentage of Wastewater-Discharging Facilities by Decade Built

Most sites have been built since 1970. Although the survey respondents reported a wide range of ages, these sites must be continually modernized to remain competitive. Most of the sites EPA visited during the MP&M site visit program had recently modernized some area of their site. Modernizing production processes and air pollution control equipment results in generation of similar wastes among all sites of various ages. Therefore, EPA did not select facility age as a basis for subcategorization.

Total Energy Requirements

EPA did not select total energy requirements as a basis for subcategorization because EPA does not expect energy requirements to vary widely on a production normalized basis. The subcategorization scheme that EPA is proposing should account for any variations in energy requirements (e.g., differences in treatment system energy requirements for metal-bearing streams versus oily waste streams). The estimated impacts of this regulation on energy consumption in the

United States is an energy increase of approximately 0.01 percent (see Section 13.0). EPA estimated the energy requirements associated with each MP&M technology option and considered these in estimating compliance costs (see Section 11.0).

Air Pollution Control Methods

Many sites control air emissions using wet air pollution control units that affect the wastewater flow rate from the site. However, based on data collected during the MP&M sampling program, wastewater generated by these devices does not affect the effectiveness of technologies used to control MP&M wastewater pollutant loadings. EPA considers wet air pollution control units additional unit operations within the MP&M category, but not as a basis of subcategorizing the category.

Industrial Sectors

EPA considered subcategorizing the MP&M category by industrial sector (e.g., aerospace, aircraft, bus and truck, electronic equipment, hardware, household equipment, instruments, job shops, mobile industrial equipment, motor vehicles, office machines, ordnance, precious metals and jewelry, printed wiring boards, railroad, ships and boats, stationary industrial equipment, and miscellaneous metal products). Sectors are broadly defined and not only include manufacturing and repair facilities within the sector (e.g., shipbuilding facilities in the ship and boat sector), but also include facilities that produce products that are used within the sector (e.g., a facility that manufactures hydraulic pumps used on ships is also in the ship and boat sector). The Agency determined that subcategorization based solely on industrial sector would require much more detailed subcategorization scheme than the approach proposed (see below). Adopting a subcategorization scheme based on industrial sector would complicate the implementation of the limitations and standards because permit writers might be required to develop facility-specific limitations across multiple subcategories.

The Agency determined that wastewater characteristics, unit operations, and raw materials used to produce products within a given sector are not always the same from site to site, and they are not always different from sector to sector. Within each sector, sites can perform a variety of unit operations on a variety of raw materials. For example, a site in the aerospace sector may primarily machine aluminum missile components and not perform any surface treatment other than alkaline cleaning. Another site in that sector may electroplate iron parts for missiles and perform little or no machining. Wastewater characteristics from these sites may differ because of the different unit operations performed and different raw materials used.

Based on the analytical data collected for this rule, EPA has not found a statistically significant difference in industrial wastewater discharge among industrial sectors when performing similar unit operations for cadmium, chromium, copper, cyanide, lead, manganese, molybdenum, nickel, oil & grease, silver, tin, TSS, and zinc. (The analytical data are available in the public record for this rulemaking.) For example, a facility that performs electroplating in the process of manufacturing office

machines produces metal-bearing wastewater with similar chemical characteristics as a facility that performs electroplating in the process of manufacturing a part for a bus. Similarly, a facility that performs repair and maintenance on a airplane engine produces oil-bearing wastewater that has similar chemical characteristics to a facility that performs repair and maintenance on construction machinery.

Most MP&M unit operations are not unique to a particular sector and are performed across all sectors. For example, all sectors may perform several of the major wastewater-generating unit operations (e.g., alkaline treatment, acid treatment, machining, electroplating). And, for the most part, the unit operations that are rarely performed (e.g., abrasive jet machining) are not performed in all sectors, but are also not limited to a single sector. Therefore, a facility in any one of the 18 industrial sectors can generate metal-bearing or oil-bearing wastewater (or a combination of both) depending on what unit operations the facility performs.

In addition, two facilities that may be part of the same sector may generate wastewater with vastly different chemical characteristics and thus require different types of treatment. For example, an automobile manufacturer and an automobile repair facility are both part of the motor vehicle sector. However, the automobile manufacturer may perform unit operations that generate metal-bearing and oil-bearing wastewater (aqueous degreasing, electroplating, chemical conversion coating, etc.) while the automobile repair facility may perform unit operations that only generate oil-bearing wastewater (machining, aqueous degreasing, impact deformation, painting, etc.).

Due to the numerous MP&M facilities that could fall under the scope of multiple sectors, EPA determined that a regulation based on MP&M industrial sector would create a variety of implementation issues for State and local regulators as well as for those multiple-sector facilities. Therefore, as mentioned above, EPA is not proposing to use industrial sector to subcategorize the industry.

After dividing facilities in the MP&M industry according to the unit operations performed (metal-bearing or oil-bearing operations), EPA concluded that raw wastewater has similar treatability across all of the MP&M sectors. Therefore, a facility that performs electroplating in the process of manufacturing office machines produces metal-bearing wastewater with similar chemical characteristics as a facility that performs electroplating in the process of manufacturing a part for a bus. Similarly, a facility that performs repair and maintenance on an airplane engine produces oil-bearing wastewater that has similar chemical characteristics to a facility that performs repair and maintenance on construction machinery.

Solid Waste Generation and Disposal

Physical and chemical characteristics of solid waste generated by the MP&M category are determined by the raw materials, unit operations, and types of air pollution control in use. Therefore, this factor does not provide a primary basis for subcategorization. The subcategorization scheme that EPA is proposing should account for any variations in solid waste generated or disposed.

EPA considered the amount of sludge generated as a result of the MP&M technology options, and included disposal of these sludges in the compliance cost estimates (see Section 11.0) and non-water quality impact assessments (see Section 13.0).

6.2 General Description of Facilities in Each Subcategory

Below is a general description of the types of facilities that fall within each of the proposed subcategories. Sections 11.0 and 12.0 present information on compliance costs and pollutant reductions associated with the MP&M proposed rule for each subcategory

6.2.1 General Metals Subcategory

As discussed above in Section 6.1, EPA has created the General Metals Subcategory as a “catch-all” for MP&M facilities that discharge metal-bearing wastewater (with or without oil-bearing wastewater) that do not fit the applicability of the Metal Finishing Job Shops, Non-Chromium Anodizing, Printed Wiring Board, or Steel Forming and Finishing Subcategories. Therefore, the General Metals Subcategory may include facilities from 17 of the 18 MP&M industrial sectors (i.e., all except the printed wiring board sector). This subcategory also includes general metals facilities that are owned and operated by states and municipalities. General metals facilities typically perform manufacturing or heavy rebuilding of metal products, parts, or machines. Facilities that perform metal finishing or electroplating operations on site, but do not meet the definition of a job shop (i.e., captive shops), would fit in the General Metals Subcategory.

EPA estimates that there are approximately 26,000 indirect dischargers and 3,800 direct dischargers that could be covered by this Subcategory. EPA currently regulates 26 percent of the facilities in this subcategory by existing effluent guidelines. The Agency estimates that, based on responses to its questionnaires, the Metal Finishing (40 CFR 433) and Electroplating (40 CFR 413) effluent guidelines cover approximately 16 percent of these facilities, and other metal related effluent guidelines (such as those discussed in Section 1.2.7. cover a portion of the wastewater discharges at an additional 10 percent of these facilities.

EPA is proposing to exclude from the MP&M regulations indirect dischargers that would fall into the General Metals Subcategory when they discharge less than or equal to 1 million gallons per year (MGY) of MP&M process wastewater to the POTW (see Section 14.0 for EPA’s discussion of flow cutoffs). Approximately 23,000 indirect dischargers in the General Metals Subcategory discharge less than 1 MGY. If EPA did not exclude these facilities, the number of permits that POTWs would issue would double, greatly increasing their burden. Facilities discharging less than 1 MGY to a POTW, however, are still subject to other applicable pretreatment standards, including those established under 40 CFR Parts 413 and 433.

6.2.2 Metal Finishing Job Shops Subcategory

Facilities in the Metal Finishing Job Shops Subcategory must meet the following criteria: (1) perform one or more of the following 6 operations: electroplating, electroless plating, anodizing, coating (chromating, phosphating, passivation, and coloring), chemical etching and milling, and printed circuit board manufacture and (2) own not more than 50 percent (on an annual area basis) of the materials undergoing metal finishing. EPA is proposing to include printed wiring board job shops in this subcategory based on the unique economics of job shop operation.

The Agency estimates that there are approximately 1,500 indirect dischargers and 15 direct dischargers in the proposed Metal Finishing Job Shops Subcategory. EPA currently regulates all facilities in this subcategory under the existing Metal Finishing or Electroplating effluent guidelines and standards. EPA is proposing to cover all of these facilities under MP&M. Therefore, facilities subject to the Metal Finishing Job Shops Subcategory will no longer be covered by the effluent guidelines and standards in 40 CFR 413 or 40 CFR 433.

EPA has identified approximately 30,000 facilities that meet the definition of job shop but do not perform one or more of the six metal finishing operations as defined in 40 CFR 433. EPA does not consider such job shops to be part of the Metal Finishing Job Shops Subcategory. These other job shops typically perform assembly, painting, and machining on a contract basis and are likely to fall in the General Metals or Oily Waste Subcategories.

6.2.3 Non-Chromium Anodizing Subcategory

Facilities covered under the Non-Chromium Anodizing Subcategory must perform aluminum anodizing without using chromic acid or dichromate sealants. Anodizing is a surface conversion operation used to alter the properties of aluminum for better corrosion resistance and heat transfer. Generally, non-chromium anodizing facilities perform sulfuric acid anodizing; however, facilities can use other acids, such as oxalic acid, for aluminum anodizing. EPA will cover anodizers that use chromic acid or dichromate in the General Metals Subcategory or, if they operate as a job shop, in the Metal Finishing Job Shops Subcategory.

EPA estimates that there are approximately 190 indirect dischargers and, to date, has not identified any direct dischargers in the Non-Chromium Anodizing Subcategory. The wastewater generated at non-chromium anodizing facilities contains very low levels of metals (with the exception of aluminum) and toxic organic pollutants. In addition, EPA determined that compliance with one of the regulatory options that EPA considered proposing would cause 60 percent of the indirect dischargers in this subcategory to close. For the reasons discussed in detail in Section 14.0, EPA is proposing to exclude wastewater from indirect discharging non-chromium anodizing facilities from the MP&M categorical pretreatment standards. Such facilities will still need to comply with the Metal Finishing (40 CFR 433) pretreatment standards for their non-chromium anodizing wastewater and the general pretreatment standards at 40 CFR Part 403.

Some facilities that could potentially fall into the Non-Chromium Anodizing Subcategory may also perform other metal surface finishing operations. If these facilities commingle their wastewater from their non-chromium anodizing operations with wastewater from other surface finishing operations (e.g., chromic acid anodizing, electroplating, chemical conversion coating) for treatment, they will not be covered by the Non-Chromium Anodizing Subcategory. Instead, the General Metals or Metal Finishing Job Shop Subcategories would apply. However, for facilities that discharge their non-chromium anodizing wastewater separately from their other surface finishing wastewater, control authorities (e.g., POTWs) and permit writers would apply the appropriate limits to each discharge.

6.2.4 Printed Wiring Board Subcategory

The Printed Wiring Board Subcategory will cover wastewater discharges from the manufacture, maintenance, and repair of printed wiring boards (i.e., circuit boards). This subcategory does not include job shops that manufacture, maintain, or repair printed wiring boards; EPA is covering these facilities under the Metal Finishing Job Shops Subcategory, as discussed in Section 6.3.2. EPA currently regulates all facilities in this subcategory by the existing Metal Finishing or Electroplating effluent guidelines and standards, but will cover all of these facilities under MP&M. Therefore, facilities subject to the Printed Wiring Board Subcategory will no longer be covered by the effluent limitations guidelines and standards in 40 CFR 413 or 40 CFR 433. Printed wiring board facilities perform unique operations, including applying, developing and stripping of photo resist, lead/tin soldering, and wave soldering. EPA estimates that there are approximately 620 indirect dischargers and 11 direct dischargers in the proposed Printed Wiring Board Subcategory.

6.2.5 Steel Forming and Finishing

Although many facilities may perform MP&M operations with steel, EPA has established the Steel Forming and Finishing Subcategory for facilities that perform MP&M operations (listed in Section 4.4) and/or cold forming operations on steel wire, rod, bar, pipe, or tube. This subcategory does not include facilities that perform those operations on other base materials. In a separate notice, EPA has proposed to revise the Iron and Steel Manufacturing effluent guidelines. The proposed revisions to the Iron and Steel regulations exclude those facilities that EPA has determined to be appropriately regulated by the MP&M rule. EPA based this decision on the information gathered during the data collection effort for the revision to the Iron and Steel Manufacturing regulations.

The MP&M Steel Forming and Finishing Subcategory does not cover wastewater generated from any hot steel forming operations, or from cold forming, electroplating, or continuous hot dip coating of steel sheet, strip, or plates. As mentioned above, the proposed Iron and Steel Manufacturing effluent guidelines will cover wastewater from such operations.

There are approximately 110 indirect dischargers and 43 direct dischargers in the Steel Forming and Finishing Subcategory. All facilities in this subcategory have permits or other control mechanisms under the existing Iron and Steel Manufacturing regulation (40 CFR 420).

EPA is proposing to cover wastewater from these steel forming and finishing operations, regardless of whether they occur at a stand-alone facility or at a steel manufacturing facility. When a steel manufacturing facility performs these MP&M steel forming and finishing operations and commingles the wastewater for treatment with wastewater from other non-MP&M unit operations, control authorities and permit writers will need to set limits that account for both the MP&M and the Iron and Steel regulations. EPA refers to this approach as the combined waste stream formula or the building block approach. For facilities that choose to discharge their MP&M steel forming and finishing wastewater separate from their iron and steel wastewater, control authorities and permit writers will apply the appropriate limits to each discharge.

6.2.6 Oily Wastes Subcategory

EPA has created the Oily Wastes Subcategory as a “catch-all” for MP&M facilities that discharge only oil-bearing wastewater and that do not fit the applicability of the other MP&M subcategories. EPA is defining the applicability of this subcategory by the presence of specific unit operations. Facilities in the Oily Wastes Subcategory must not fit the applicability of the Railroad Line Maintenance or Shipbuilding Dry Dock Subcategories and must only discharge wastewater from one or more of the following MP&M unit operations: alkaline cleaning for oil removal, aqueous degreasing, corrosion preventive coating, floor cleaning, grinding, heat treating, impact deformation, machining, pressure deformation, solvent degreasing, testing (e.g., hydrostatic, dye penetrant, ultrasonic, magnetic flux), painting, steam cleaning, and laundering. Facilities in this subcategory are predominantly machine shops or maintenance and repair shops. EPA has defined “corrosion preventive coating” as the application of removable oily or organic solutions to protect metal surfaces against corrosive environments. Corrosion preventive coatings include, but are not limited to: petroleum compounds, oils, hard dry-film compounds, solvent-cutback petroleum-based compounds, emulsions, water-displacing polar compounds, and fingerprint removers and neutralizers. Corrosion preventive coating does not include electroplating, painting, and chemical conversion coating (including phosphate conversion coating) operations. Based on EPA’s analytical database for this proposal, EPA believes that wastewater generated from phosphate conversion coating operations contains high levels of zinc and manganese.

If a facility discharges wastewater from any of the operations listed above but also discharges wastewater from other MP&M operations (listed in Section 4.4), it does not meet the criteria of the Oily Wastes Subcategory. EPA has determined that other MP&M unit operations generate metal-bearing wastewater or combination metal- and oil-bearing wastewater and require different treatment technologies (e.g., chemical precipitation). EPA included wastewater from floor cleaning and testing operations in the Oily Wastes Subcategory after confirming through a review of the

analytical data that there is little or no metals content in these two streams. This subcategory also includes municipal and state-owned facilities performing only the listed operations.

Like the General Metals Subcategory, the Oily Wastes Subcategory may include facilities from 17 of the 18 MP&M industrial sectors (i.e., all except the printed wiring board sector).

EPA estimates that there are approximately 28,500 indirect dischargers and 900 direct dischargers in the Oily Wastes Subcategory. EPA has concluded that less than 1 percent of the MP&M process wastewater discharged from these facilities in this subcategory is covered by existing effluent guidelines.

In an effort to relieve administrative burden on POTWs that will implement the MP&M regulation, EPA is proposing to exclude from the MP&M regulations indirect dischargers that would fall into the Oily Wastes Subcategory when they discharge less than or equal to 2 MGY of MP&M process wastewater to the POTW. (See Section 14.0 for a discussion of the low-flow exclusion for indirect dischargers in the Oily Waste Subcategory.)

6.2.7 Railroad Line Maintenance Subcategory

EPA has developed the Railroad Line Maintenance Subcategory to cover facilities that perform routine cleaning and light maintenance (mostly consisting of parts replacement) on railroad engines, cars, car-wheel trucks, and similar parts or machines. More specifically, these facilities discharge wastewater from only those MP&M unit operations that EPA defines as oily operations (see Section 6.2.6, above), storm water clean-up (which is not covered by the proposed regulation), and/or washing of final products. EPA considers “washing of final product” an MP&M “oily” operation for this subcategory. The Agency reviewed the analytical wastewater sampling data for this waste stream at railroad line maintenance facilities and determined that there is little or no metal content. However, for other primarily oily subcategories (oily wastes and shipbuilding dry docks), EPA does not consider this unit operation an MP&M “oily” operation. Railroad line maintenance facilities are similar to facilities in the Oily Wastes Subcategory in that they produce oil-bearing wastewater and do not perform MP&M operations that generate wastewater that requires metals removal treatment technology. This subcategory does not include railroad manufacturing facilities or railroad overhaul or heavy maintenance facilities.

EPA estimates that there are approximately 800 indirect dischargers and 35 direct dischargers in the Railroad Line Maintenance Subcategory. The wastewater generated at railroad line maintenance facilities contains very low levels of metals and toxic organic pollutants. EPA is proposing to exclude wastewater from indirect discharging railroad line maintenance facilities from the MP&M regulations. (See Section 14.0 for a discussion on the rationale for this exclusion). However, EPA is proposing to regulate conventional pollutants for direct dischargers in this subcategory.

6.2.8 Shipbuilding Dry Dock Subcategory

EPA has created the Shipbuilding Dry Dock Subcategory to specifically cover MP&M process wastewater generated in or on dry docks and similar structures such as graving docks, building ways, marine railways, and lift barges at shipbuilding facilities (or shipyards). Shipbuilding facilities use these structures to maintain, repair, or rebuild existing ships, or perform the final assembly and launching of new ships (including barges). Shipbuilders use these structures to reach surfaces and parts that would otherwise be under water. Since dry docks and similar structures include sumps or containment systems, shipyards can control the discharge of pollutants to surface water. Typical MP&M operations that occur in dry docks and similar structures include abrasive blasting, hydro blasting, painting, welding, corrosion preventive coating, floor cleaning, aqueous degreasing, and testing (e.g., hydrostatic testing). Not all of these unit operations generate wastewater. EPA will also cover wastewater generated when a shipyard cleans a ship's hull in a dry dock (or similar structure) to remove marine life (e.g., barnacles) only in preparation for performing MP&M operations.

This subcategory will cover only process wastewater generated and discharged from MP&M operations inside and outside ships (including bilge water) that occur in or on dry docks or similar structures. The Agency is not including MP&M process wastewater that is generated at other locations at the shipyard ("on-shore" operations) in this subcategory. EPA expects that wastewater from these "on-shore" shipbuilding operations (e.g., electroplating, plasma arc cutting) will fall under either the General Metals or Oily Wastes Subcategories. Also, EPA is not including wastewater generated onboard ships when they are afloat (i.e., not in dry docks or similar structures). For U.S. military ships, EPA is in the process of establishing standards under the Uniform National Discharge Standards (UNDS) pursuant to Section 312(n) of the CWA (See 64 F.R. 25125; May 10, 1999) to regulate discharges of wastewater generated onboard these ships when they are in U.S. waters and are afloat (e.g., at a shipyard's dock).

In addition to MP&M wastewater, EPA identified three other types of water streams in or on dry docks and similar structures: flooding water, dry dock ballast water, and storm water. Flooding water enters and exits the dry dock or similar structure prior to performing any MP&M operations. For example, in a graving dock, the gates are opened, allowing flooding water in and ships to float inside the chamber. Then the flooding water is drained, leaving the ship's exterior exposed so shipyard employees can repair and maintain the ship's hull. Dry dock ballast water serves a similar purpose. It is used to lower (or sink) a floating dry dock so that a ship can float over it. Then the dry dock ballast water is pumped out, raising the dry dock with the ship on top. Flooding water and dry dock ballast water do not come into contact with MP&M operations. Finally, since these structures are located outdoors and are exposed to the elements, storm water may fall in or on the dry dock or similar structures.

EPA is proposing to exclude all three of these water streams from the MP&M rule. EPA has determined that storm water at these facilities is covered by EPA's recent Storm Water Multi-Sector General permit, similar general permits issued by authorized states, and individual storm water

permits. In general, storm water permits at shipyards include best management practices (BMPS) that are designed to prevent the contamination of storm water. For example, these practices include sweeping of areas after completion of abrasive blasting or painting.

EPA estimates that there are six indirect dischargers and six direct dischargers in the Shipbuilding Dry Dock Subcategory. Many shipbuilders operate multiple dry docks (or similar structures); this is the number of estimated facilities (not dry docks) that discharge MP&M process wastewater from dry docks or similar structures. Many shipyards perform only dry MP&M unit operations in their dry docks (and similar structures) or do not discharge wastewater generated in dry docks (and similar structures) from MP&M unit operations. Many shipyards prefer to handle this wastewater as hazardous, and contract haul it offsite due to the possible presence of copper (used as antifoulant) in paint chips from abrasive blasting operations. EPA has determined that shipyards currently discharging MP&M wastewater from dry docks have oil/water separation technology in place, such as dissolved air flotation (DAF).

The wastewater discharged from dry docks and similar structures contains very low levels of metals and toxic organic pollutants. EPA is proposing to exclude wastewater from indirect discharging dry docks and similar structures at shipbuilding facilities from the MP&M rule. (See Section 14.0 for a discussion on the rationale for this exclusion). However, EPA is proposing to regulate conventional pollutants for direct dischargers in this subcategory.

7.0 SELECTION OF POLLUTANT PARAMETERS

EPA conducted a study of MP&M wastewater to determine the presence of priority, conventional, and nonconventional pollutant parameters. The Agency defines priority pollutant parameters in Section 307(a)(1) of the CWA. In Table 7-1, EPA lists the 126 specific priority pollutants listed in 40 CFR Part 423, Appendix A. Section 301(b)(2) of the CWA requires EPA to regulate priority pollutants if EPA determines them to be present at significant concentrations. Section 304(a)(4) of the CWA defines conventional pollutant parameters to be biochemical oxygen demand, total suspended solids, oil and grease, pH, and fecal coliform. These pollutant parameters are subject to regulation as specified in Sections 304(a)(4), 304(b)(1)(a), 301(b)(2)(e), and 306 of the CWA. Nonconventional pollutant parameters are those that are neither priority nor conventional pollutant parameters. These include nonconventional metal pollutants, nonconventional organic pollutants, and other nonconventional pollutant parameters. Sections 301(b)(2)(f) and 301(g) of the CWA give EPA the authority to regulate nonconventional pollutant parameters, as appropriate, based on technical and economic considerations.

Table 7-1
Priority Pollutant List^a

1 Acenaphthene	66 Bis(2-ethylhexyl) Phthalate
2 Acrolein	67 Butyl Benzyl Phthalate
3 Acrylonitrile	68 Di-n-butyl Phthalate
4 Benzene	69 Di-n-octyl Phthalate
5 Benzidine	70 Diethyl Phthalate
6 Carbon Tetrachloride (Tetrachloromethane)	71 Dimethyl Phthalate
7 Chlorobenzene	72 Benzo(a)anthracene (1,2-Benzanthracene)
8 1,2,4-Trichlorobenzene	73 Benzo(a)pyrene (3,4-Benzopyrene)
9 Hexachlorobenzene	74 Benzo(b)fluoranthene (3,4-Benzo fluoranthene)
10 1,2-Dichloroethane	75 Benzo(k)fluoranthene (11,12-Benzofluoranthene)
11 1,1,1-Trichloroethane	76 Chrysene
12 Hexachloroethane	77 Acenaphthylene
13 1,1-Dichloroethane	78 Anthracene
14 1,1,2-Trichloroethane	79 Benzo(ghi)perylene (1,12-Benzoperylene)
15 1,1,2,2-Tetrachloroethane	80 Fluorene
16 Chloroethane	81 Phenanthrene
17 Removed	82 Dibenzo(a,h)anthracene (1,2,5,6-Dibenzanthracene)
18 Bis(2-chloroethyl) Ether	83 Indeno(1,2,3-cd)pyrene (2,3-o-Phenylenepylene)
19 2-Chloroethyl Vinyl Ether (mixed)	84 Pyrene
20 2-Chloronaphthalene	85 Tetrachloroethylene (Tetrachloroethene)
21 2,4,6-Trichlorophenol	86 Toluene
22 Parachlorometa Cresol (4-Chloro-3-Methylphenol)	87 Trichloroethylene (Trichloroethene)
23 Chloroform (Trichloromethane)	88 Vinyl Chloride (Chloroethylene)
24 2-Chlorophenol	89 Aldrin
25 1,2-Dichlorobenzene	90 Dieldrin
26 1,3-Dichlorobenzene	91 Chlordane (Technical Mixture & Metabolites)
27 1,4-Dichlorobenzene	92 4,4'-DDT (p,p'-DDT)
28 3,3'-Dichlorobenzidine	93 4,4'-DDE (p,p'-DDX)
29 1,1-Dichloroethylene	94 4,4'-DDD (p,p'-TDE)
30 1,2-Trans-Dichloroethylene	95 Alpha-endosulfan
31 2,4-Dichlorophenol	96 Beta-endosulfan
32 1,2-Dichloropropane	97 Endosulfan Sulfate
33 1,3-Dichloropropylene (Trans-1,3-Dichloropropene)	98 Endrin
34 2,4-Dimethylphenol	99 Endrin Aldehyde
35 2,4-Dinitrotoluene	100 Heptachlor
36 2,6-Dinitrotoluene	101 Heptachlor Epoxide
37 1,2-Diphenylhydrazine	102 Alpha-BHC
38 Ethylbenzene	103 Beta-BHC
39 Fluoranthene	104 Gamma-BHC (Lindane)
40 4-Chlorophenyl Phenyl Ether	105 Delta-BHC
41 4-Bromophenyl Phenyl Ether	106 PCB-1242 (Arochlor 1242)
42 Bis(2-Chloroisopropyl) Ether	107 PCB-1254 (Arochlor 1254)
43 Bis(2-Chloroethoxy) Methane	108 PCB-1221 (Arochlor 1221)
44 Methylene Chloride (Dichloromethane)	109 PCB-1232 (Arochlor 1232)
45 Methyl Chloride (Chloromethane)	110 PCB-1248 (Arochlor 1248)
46 Methyl Bromide (Bromomethane)	111 PCB-1260 (Arochlor 1260)
47 Bromoform (Tribromomethane)	112 PCB-1016 (Arochlor 1016)
48 Dichlorobromomethane (Bromodichloromethane)	113 Toxaphene
49 Removed	114 Antimony (total)
50 Removed	115 Arsenic (total)
51 Chlorodibromomethane (Dibromochloromethane)	116 Asbestos (fibrous)
52 Hexachlorobutadiene	117 Beryllium (total)
53 Hexachlorocyclopentadiene	118 Cadmium (total)
54 Isophorone	119 Chromium (total)
55 Naphthalene	120 Copper (total)
56 Nitrobenzene	121 Cyanide (total)
57 2-Nitrophenol	122 Lead (total)
58 4-Nitrophenol	123 Mercury (total)
59 2,4-Dinitrophenol	124 Nickel (total)
60 4,6-Dinitro-o-Cresol (Phenol, 2-methyl-4,6-dinitro)	125 Selenium (total)
61 N-Nitrosodimethylamine	126 Silver (total)
62 N-Nitrosodiphenylamine	127 Thallium (total)
63 N-Nitrosodi-n-propylamine (Di-n-propylnitrosamine)	128 Zinc (total)
64 Pentachlorophenol	129 2,3,7,8-Tetrachloro-dibenzo-p-Dioxin (TCDD)
65 Phenol	

Source: 40 CFR Part 423, Appendix A.

^aPriority pollutants are numbered 1 through 129 but include 126 pollutants since EPA removed three pollutants from the list (Numbers 17, 49, and 50).

EPA considered 302 metal and organic pollutant parameters listed in The 1990 Industrial Technology Division List of Analytes (1) for potential regulation under the MP&M proposed rule. The Agency also considered 22 conventional and other nonconventional pollutant parameters for potential regulation under the MP&M proposal. These 327 pollutant parameters of which the Agency measured in the MP&M sampling program are identified in Section 3.0.

The Agency did not consider fecal coliform, a conventional pollutant parameter, for regulation under the MP&M rule; therefore, it is not included in the 327 pollutant parameters discussed above. The presence of fecal coliform bacteria, a microorganism that resides in the intestinal tract of humans and other warm-blooded animals, indicates that wastewater has been contaminated with feces from humans or other warm-blooded animals. EPA does not expect fecal coliform to be present in process wastewater from MP&M sites because sanitary wastewater is discharged separately from process wastewater.

Section 7.1 discusses the criteria used to identify pollutant parameters of concern (i.e., considered for regulation) under the MP&M proposed rule. Sections 7.2 and 7.3 present the criteria used to select pollutant parameters for regulation for direct and indirect dischargers, respectively. Section 7.4 lists the references used in this chapter.

7.1 Identification of Pollutant Parameters of Concern

EPA analyzed for the 327 pollutant parameters discussed above in over 1,932 samples of wastewater collected during the MP&M sampling program described in Section 3.0. Of these samples, EPA collected 727 from unit operation wastewater, 693 from influent-to-treatment wastewater, and 684 from effluent-from-treatment wastewater. The Agency notes that a number of these samples fit into more than one category: EPA classified 20 unit operations as influents-to-treatment and 152 influents-to-treatment for one technology as effluents-from-treatment for a second technology. EPA reduced the list of 324 pollutants to 132 pollutants (referred to as pollutants of concern or POCs) for further consideration by retaining only those pollutants that met the following criteria:

- C EPA detected the pollutant parameter in at least three samples collected during the MP&M sampling program.
- C The average concentration of the pollutant parameter in samples of wastewater from MP&M unit operations and influents-to-treatment was at least five times the minimum level (ML) or the average concentration of effluent-from-treatment wastewater samples exceeded five times the minimum level. EPA describes the ML as “the lowest level at which the entire analytical system must give a recognizable signal and an acceptable calibration point for the analyte” (2).

- C EPA analyzed the pollutant parameter in a quantitative manner following the appropriate quality assurance/quality control (QA/QC) procedures. To meet this criteria, the Agency excluded wastewater analyses performed solely for certain semi-quantitative “screening” purposes. EPA performed these semi-quantitative analyses only in unusual cases (e.g. to qualitatively screen for the presence of a rare metal such as osmium).

For the first criterion, EPA used data from the unit operation, influent-to-treatment, and effluent-from-treatment wastewater samples to determine the total number of detected samples for each pollutant parameter. EPA calculated the average pollutant concentrations from the unit operation and influent-to-treatment wastewater samples to determine if the data met the second criterion. Separately, EPA also included effluent-from-treatment wastewater pollutant concentrations in this assessment, and the following pollutants passed the second criterion: 1,1-dichloroethene, chloroform, diphenyl ether, isophorone, n-nitrosopiperidine, and trichlorofluoromethane. Because these pollutants have concentrations exceeding five times the ML in the effluent streams, EPA considered them pollutants of concern. Of the 324 pollutant parameters initially considered by the Agency for potential regulation under MP&M, EPA excluded 192 as pollutant parameters of concern for the following reasons:

- C EPA did not detect one hundred and thirteen (113) pollutant parameters in samples collected during the MP&M sampling program. Table 7-2 lists these pollutant parameters.
- C EPA detected fifty (50) in less than three samples collected during the MP&M sampling program. Table 7-3 lists these pollutant parameters.
- C EPA detected thirty (30) pollutant parameters at average concentrations that were less than five times the ML in unit operations and influent-to-treatment or did not have a detection limit (acidity, total alkalinity, and pH). Table 7-4 lists these pollutant parameters.
- C EPA did not analyze five of the remaining pollutants (strontium, potassium, sulfur, silicon, and phosphorus) in a quantitative manner. Rather, EPA performed analyses for these pollutants using semi-quantitative methods for “screening” purposes to determine if these analytes were present. Therefore, the Agency did not subject these analytes to the QA/QC procedures required by analytical method 1620. Based on the screening results, the Agency performed a full quantitative analysis for gold, palladium, platinum, and rhodium.

Table 7-2

**Pollutant Parameters Not Detected in Any Samples Collected During the
MP&M Sampling Program**

Priority Pollutant Parameters	
1,2-Dichloropropane	Benzo(K)Fluoranthene
1,3-Dichlorobenzene	Bis(2-Chloroisopropyl) Ether
2-Chloroethylvinyl Ether	Chrysene
3,3'-Dichlorobenzidine	Dibenzo(A,H)Anthracene
4-Bromophenyl Phenyl Ether	Hexachlorobenzene
4-Chlorophenylphenyl Ether	Hexachlorobutadiene
Acenaphthylene	Hexachlorocyclopentadiene
Benzdine	Hexachloroethane
Benzo(A)Anthracene	Indeno(1,2,3-Cd)Pyrene
Benzo(A)Pyrene	Pentachlorophenol
Benzo(B)Fluoranthene	Trans-1,2-Dichloroethene
Benzo(Ghi)Perylene	Trans-1,3-Dichloropropene
Nonconventional Organic Pollutant Parameters	
1,2,3-Trichlorobenzene	Aniline, 2,4,5-Trimethyl-
1,2,3-Trichloropropane	Aramite
1,2,3-Trimethoxybenzene	Benzanthrone
1,2,4,5-Tetrachlorobenzene	Benzenethiol
1,2-Dibromo-3-Chloropropane	Biphenyl, 4-Nitro
1,2-Dibromoethane	Chloroacetonitrile
1,3-Butadiene, 2-Chloro	Crotonaldehyde
1,3-Dichloro-2-Propanol	Crotoxypnos
1,3-Dichloropropane	Diethyl Ether
1,5-Naphthalenediamine	Dimethyl Sulfone
1-Chloro-3-Nitrobenzene	Diphenyldisulfide
1-Phenylnaphthalene	Ethyl Cyanide
2,3,4,6-Tetrachlorophenol	Ethyl Methacrylate
2,3,6-Trichlorophenol	Ethyl Methanesulfonate
2,3-Benzofluorene	Hexachloropropene
2,3-Dichloroaniline	Iodomethane
2,3-Dichloronitrobenzene	Isosafrole
2,4,5-Trichlorophenol	Longifolene
2,6-Dichloro-4-Nitroaniline	Malachite Green
2,6-Dichlorophenol	Mestranol
2-Methylbenzothiazole	Methapyrilene
2-Nitroaniline	Methyl Methanesulfonate
2-Phenylnaphthalene	n-Nitrosodiethylamine

Table 7-2 (Continued)

Nonconventional Organic Pollutant Parameters (continued)	
2-Propen-1-ol	o-Toluidine, 5-Chloro-
2-Propenenitrile, 2-Methyl-	p-Dimethylaminoazobenzene
3,3'-Dimethoxybenzidine	Pentachlorobenzene
3,5-Dibromo 4-Hydroxybenzonitrile	Pentachloroethane
3-Chloropropene	Perylene
3-Methylcholanthrene	Phenacetin
3-Nitroaniline	Pronamide
4,4'-Methylenebis(2-Chloroaniline)	Squalene
4,5-Methylene Phenanthrene	Thioacetamide
4-Chloro-2-Nitroaniline	Trans-1,4-Dichloro-2-Butene
5-Nitro-O-Toluidine	Triphenylene
7,12-Dimethylbenz(A)Anthracene	Vinyl Acetate
Nonconventional Metal Pollutant Parameters	
Cerium	Praseodymium
Erbium	Rhenium
Europium	Samarium
Gadolinium	Scandium
Gallium	Tellurium
Germanium	Terbium
Holmium	Thorium
Indium	Thulium
Iodine	Uranium
Lanthanum	

Source: MP&M sampling data.

Table 7-3

**Pollutant Parameters Detected in Less Than Three Samples Collected
During the MP&M Sampling Program**

Priority Pollutant Parameters	
1,1,2,2-Tetrachloroethane	2-Chloronaphthalene
1,1,2-Trichloroethane	2-Chlorophenol
1,2,4-Trichlorobenzene	Acrylonitrile
1,2-Dichlorobenzene	Bis(2-Chloroethoxy)Methane
1,2-Dichloroethane	Bis(2-Chloroethyl) Ether
1,2-Diphenylhydrazine	Bromomethane
1,4-Dichlorobenzene	Nitrobenzene
2,4-Dichlorophenol	n-Nitrosodi-n-Propylamine
2,4-Dinitrotoluene	Vinyl Chloride
Nonconventional Organic Pollutant Parameters	
1,1,1,2-Tetrachloroethane	Ethylenethiourea
1,2:3,4-Diepoxybutane	n-Nitrosodi-n-Butylamine
1,3,5-Trithiane	n-Nitrosomethylphenylamine
1,4-Dinitrobenzene	o-Anisidine
1,4-Naphthoquinone	p-Chloroaniline
1-Naphthylamine	Pentamethylbenzene
2,6-Di-Tert-Butyl-P-Benzoquinone	Phenothiazine
2-Picoline	p-Nitroaniline
4-Aminobiphenyl	Resorcinol
Beta-Naphthylamine	Safrole
Carbazole	Thianaphthene
Cis-1,3-Dichloropropene	Thioxanthe-9-One
Dibromomethane	Toluene, 2,4-Diamino-
Nonconventional Metal Pollutant Parameters	
Dysprosium	Rhodium
Hafnium	Ruthenium
Neodymium	Zirconium

Source: MP&M sampling data.

Table 7-4

Pollutant Parameters Detected at Average Concentrations of Less Than Five Times the Minimum Level During the MP&M Sampling Program

Priority Pollutant Parameters	
2,4,6-Trichlorophenol	Chloroform
4,6-Dinitro-o-Cresol	Chloromethane
Benzene	Dibromochloromethane
Bromodichloromethane	Diethyl Phthalate
Carbon Tetrachloride (Tetrachloromethane)	Tribromomethane
Nonconventional Organic Pollutant Parameters	
2-(Methylthio)Benzothiazole	n-Nitrosopiperidine
Diphenyl Ether	o-Toluidine
n-Nitrosomethylethylamine	Trichlorofluoromethane
n-Nitrosomorpholine	
Nonconventional Metal Pollutant Parameters	
Bismuth	Osmium
Iridium	Palladium
Lithium	Tantalum
Lutetium	Tungsten
Niobium	Ytterbium

Source: MP&M sampling data.

After excluding these pollutants, EPA defines the 132 remaining pollutants as pollutant parameters of concern (POCs). These include 48 priority pollutant parameters (34 priority organic pollutants, 13 priority metal pollutants, and cyanide), 3 conventional pollutant parameters, and 81 nonconventional pollutant parameters (50 organic pollutants, 15 metal pollutants, and 16 other nonconventional pollutants). These pollutant parameters, along with the number of times EPA analyzed and detected each pollutant parameter in the influent or in unit operations and the corresponding average concentration (excluding nondetected pollutants), are shown in Table 7-5.

Table 7-5

**Pollutant Parameters Selected for Further
Consideration Under the MP&M Proposed Rule**

Pollutant Parameter	No. of Times Analyzed for All Samples	No. of Times Detected for All Samples	Average Concentration in Samples from Unit Operations and Treatment Influent (mg/L)
Priority Organic Pollutants			
1,1,1-Trichloroethane	1043	28	0.327
1,1-Dichloroethane	1043	7	0.091
1,1-Dichloroethylene	1043	3	0.418
2,4-Dimethylphenol	994	31	0.078
2,4-Dinitrophenol	946	4	83.7
2,6-Dinitrotoluene	1029	3	2.73
2-Nitrophenol	1021	9	0.394
4-Chloro-m-cresol	1003	95	260
4-Nitrophenol	969	5	2.99
Acenaphthene	1029	6	0.332
Acrolein	1003	5	0.307
Anthracene	1029	4	0.117
Bis(2-Ethylhexyl) Phthalate	1028	211	4.15
Benzyl Butyl Phthalate	1026	16	1.08
Chlorobenzene	1043	7	0.282
Chloroethane	1043	4	4.22
Chloroform	1043	331	0.049
Di-N-Butyl Phthalate	1026	41	0.352
Di-N-Octyl Phthalate	1028	18	1.58
Dimethyl Phthalate	994	3	0.739
Ethylbenzene	1043	61	0.165
Fluoranthene	1028	4	0.132
Fluorene	1029	18	0.956
Isophorone	996	3	0*
Methylene Chloride	1043	52	0.403
n-Nitrosodimethylamine	996	3	3.68
N-Nitrosodiphenylamine	1029	15	1.14
Naphthalene	1029	71	0.638
Phenanthrene	1029	45	0.500
Phenol	1021	244	10.1
Pyrene	1028	5	0.219

Table 7-5 (Continued)

Pollutant Parameter	No. of Times Analyzed for All Samples	No. of Times Detected for All Samples	Average Concentration in Samples from Unit Operations and Treatment Influent (mg/L)
Tetrachloroethene	1043	23	0.210
Priority Organic Pollutants (continued)			
Toluene	1043	83	0.230
Trichloroethylene	1042	40	0.092
Priority Metal Pollutants			
Antimony	1956	606	6.12
Arsenic	1972	627	0.178
Beryllium	1972	301	0.147
Cadmium	1972	873	244
Chromium	1972	1480	1,029
Copper	1972	1752	495
Cyanide	406	327	2,072
Lead	1972	911	30.0
Mercury	1970	321	0.0014
Nickel	1972	1518	356
Selenium	1956	317	0.137
Silver	1972	698	0.531
Thallium	1956	206	0.065
Zinc	1971	1691	188
Conventional Pollutants			
BOD 5-Day (Carbonaceous)	1005	757	2,015
Oil And Grease (As HEM)	1028	554	2,308
Total Suspended Solids	1959	1563	1,007
Nonconventional Organic Pollutants			
1,4-Dioxane	1003	33	0.854
1-Bromo-2-Chlorobenzene	989	8	0.233
1-Bromo-3-Chlorobenzene	989	6	0.135
1-Methylfluorene	989	24	0.347
1-Methylphenanthrene	989	29	0.581
2-Butanone	1003	160	1.59
2-Hexanone	1003	7	1.26
2-Isopropyl-naphthalene	989	6	3.21
2-Methylnaphthalene	989	61	0.775
2-Propanone	1003	593	3.14
3,6-Dimethylphenanthrene	989	13	1.24
4-Methyl-2-Pentanone	1003	91	5.19
Acetophenone	989	10	0.159

Table 7-5 (Continued)

Pollutant Parameter	No. of Times Analyzed for All Samples	No. of Times Detected for All Samples	Average Concentration in Samples from Unit Operations and Treatment Influent (mg/L)
Alpha-Terpineol	978	133	13.6
Nonconventional Organic Pollutants (continued)			
Aniline	989	19	0.684
Benzoic Acid	989	202	277
Benzyl Alcohol	989	61	1.23
Biphenyl	989	23	0.174
Carbon Disulfide	1003	63	0.408
Dibenzofuran	989	4	0.055
Dibenzothiophene	988	6	0.240
Diphenyl Ether	989	5	0.047
Diphenylamine	989	14	0.704
Hexanoic Acid	989	237	15.2
Isobutyl Alcohol	1003	19	0.167
m+p Xylene	595	31	0.159
m-Xylene	408	21	0.498
Methyl Methacrylate	1003	6	0.396
n,n-Dimethylformamide	989	63	0.193
n-Decane	989	67	2.10
n-Docosane	989	108	3.47
n-Dodecane	989	125	13.8
n-Eicosane	988	156	3.30
n-Hexacosane	989	95	5.84
n-Hexadecane	989	168	6.27
n-Nitrosopiperidine	989	4	0.020
n-Octacosane	989	40	7.45
n-Octadecane	989	174	5.74
n-Tetracosane	988	90	4.13
n-Tetradecane	989	158	12.7
n-Triacontane	988	55	2.69
o+p Xylene	408	30	0.256
o-Cresol	989	16	0.067
o-Xylene	595	40	0.058
p-Cresol	989	82	0.293
p-Cymene	989	21	0.988
Pyridine	989	37	0.920
Styrene	989	9	0.261
Trichlorofluoromethane	1043	12	0.049

Table 7-5 (Continued)

Pollutant Parameter	No. of Times Analyzed for All Samples	No. of Times Detected for All Samples	Average Concentration in Samples from Unit Operations and Treatment Influent (mg/L)
Tripolyleneglycol Methyl Ether	989	141	190
Nonconventional Metal Pollutants			
Aluminum	1972	1520	166
Barium	1972	1651	1.75
Boron	1913	1645	85.0
Calcium	1972	1929	68.4
Cobalt	1972	640	12.8
Gold	161	104	16.2
Iron	1972	1743	777
Magnesium	1972	1803	53.8
Manganese	1972	1620	43.4
Molybdenum	1972	1091	2.97
Sodium	1972	1953	3,384
Tin	1912	850	153
Titanium	1913	949	32.6
Vanadium	1972	504	5.31
Yttrium	1913	306	0.061
Other Nonconventional Pollutants			
Amenable Cyanide	160	128	44.3
Ammonia As Nitrogen	689	569	385
Chemical Oxygen Demand (COD)	1461	1343	11,289
Chloride	677	631	5,526
Fluoride	688	618	301
Hexavalent Chromium	1074	268	1.78
Sulfate	1171	1086	7,046
Total Dissolved Solids	1953	1948	21,883
Total Kjeldahl Nitrogen	661	572	606
Total Organic Carbon (TOC)	997	838	3,385
Total Petroleum Hydrocarbons (As SGT-HEM)	1016	350	841
Total Phosphorus	500	452	170
Total Recoverable Phenolics	1357	871	11.7
Total Sulfide	215	80	6.50
Weak-Acid Dissociable Cyanide	72	62	19.4
Ziram	31	22	1.41

Source: MP&M sampling data.

7.2 Pollutants Proposed to be Regulated for Direct Dischargers

EPA developed the list of pollutants to be regulated for each of the MP&M subcategories from the pollutants of concern list discussed above. As a first step in the selection of regulated pollutants, the Agency grouped the MP&M subcategories (discussed in Section 6) according to whether the facilities in the subcategory generated wastewater with high metals content (metal-bearing) or wastewater with low concentration of metals and high oil and grease content (oil-bearing). EPA determined that the following subcategories generate metal-bearing wastewater: General Metals, Metal Finishing Job Shops, Non-Chromium Anodizing, Printed Wiring Board, and Steel Forming and Finishing. For the remainder of the subcategories (Oily Wastes, Railroad Line Maintenance, and Shipbuilding Dry Docks), the Agency determined that they generate oil-bearing wastewater. For both of these groups, the Agency analyzed the concentrations and prevalence of the pollutants of concern from unit operations, unit operation rinses, and influent to treatment systems in order to determine which POCs EPA could eliminate from its list of pollutants considered for regulation. The tables in Section 5 summarize the data that EPA considered in determining the pollutants selected for regulation.

EPA considered the following factors in determining which POCs should be eliminated from the potential list of regulated pollutants:

- C The pollutant is controlled through the regulation of other pollutants.
- C The pollutant is present in only trace amounts in the subcategory and/or is not likely to cause toxic effects.
- C The pollutant may serve as a treatment chemical.
- C The pollutant is not controlled by the selected BPT/BAT technology.

7.2.1 **Regulated Pollutant Analysis for Direct Dischargers in the Metal-Bearing Subcategories**

As mentioned in Section 7.2, EPA determined that the following subcategories generate metal-bearing wastewater: General Metals, Metal Finishing Job Shops, Non-Chromium Anodizing, Printed Wiring Board, and Steel Forming and Finishing. This section describes EPA's proposed regulated pollutant selection criteria for direct dischargers in the metal-bearing subcategories.

EPA did not select the 42 pollutants of concern present in Table 7-6 because they are controlled through the regulation of other pollutants in the metal-bearing subcategories.

Table 7-6

Pollutants Not Selected for Proposed Regulation for the Metal-Bearing Subcategories Because They Are Controlled Through the Regulation of Other Pollutants

Conventional Pollutant	
BOD ₅	
Other Nonconventional Pollutant	
COD	Total Recoverable Phenolics
Hexavalent Chromium	Weak-Acid Dissociable Cyanide
Total Petroleum Hydrocarbons (as SGT-HEM)	
Nonconventional Organic Pollutants	
1,4-Dioxane	n-Decane
1-Bromo-2-Chlorobenzene	n-Docosane
1-Bromo-3-Chlorobenzene	n-Dodecane
2-Butanone	n-Eicosane
2-Hexanone	n-Hexacosane
2-Propanone	n-Nitrosopiperidine
4-Methyl-2-Pentanone	n-Octacosane
Acetophenone	n-Octadecane
Alpha-Terpineol	n-Tetracosane
Benzyl Alcohol	n-Triacontane
Diphenyl Ether	o+p Xylene
Diphenylamine	o-Cresol
Hexanoic Acid	o-Xylene
Isobutyl Alcohol	p-Cresol
m+p Xylene	Pyridine
m-Xylene	Styrene
Methyl Methacrylate	Trichlorofluoromethane
n,n-Dimethylformamide	Tripropyleneglycol Methyl Ether

BOD₅ and COD are methods for measuring the oxygen demand of wastewater. EPA is proposing a limit for Total Organic Carbon (TOC), an alternate method that measures all oxidizable organic material in a waste stream, including some organic chemicals not oxidized (and, therefore not detected) in the BOD₅ and COD tests. EPA chose TOC as an indicator parameter because of its ability to measure all types of organic pollutants and because it found TOC to be the best general indicator parameter for measuring the sum of organic compounds in an MP&M waste stream. EPA is not proposing a limit for hexavalent chromium because it has selected total chromium for regulation. Weak-acid dissociable cyanide will be controlled through the regulation of total cyanide (or amenable

cyanide). EPA did not propose a limit for Total Petroleum Hydrocarbons (TPH) (as SGT-HEM) because it believes that the regulation of oil and grease (O&G) and EPA's proposed organics control options will control the discharge of TPH (as SGT-HEM). The parameter Total Recoverable Phenolics will be controlled through the regulation of the Total Organics Parameter (TOP) which includes compounds such as phenol. EPA also believes that the list of 36 nonconventional organic compounds listed in the table above will be controlled through the regulation of TOP. The organic parameters that comprise the TOP are explained in more detail later in this section.

EPA determined that it was not necessary to propose limits for the 12 metals listed in Table 7-7 because it detected these metals at low levels in its sampling of MP&M wastewater. As shown in Table 5-14, the median concentration at the influent to treatment for all of these metals was less than 0.1 mg/L. EPA also decided not to propose a limit for fluoride because the Agency did not detect fluoride at concentrations that would cause toxic effects. As shown in Table 5-14, the median concentration of fluoride at the influent to treatment was 1.55 mg/L. This value is below EPA's primary drinking water standard for fluoride (the maximum contaminant level (MCL)) which is 4 mg/L.

Table 7-7

Pollutants Not Selected for Proposed Regulation for the Metal-Bearing Subcategories Because They Are Present in Only Trace Amounts and/or Are Not Likely to Cause Toxic Effects

Priority Metals	
Antimony	Mercury
Arsenic	Selenium
Beryllium	Thallium
Nonconventional Metals	
Barium	Titanium
Cobalt	Vanadium
Gold	Yttrium
Other Nonconventional Pollutant	
Fluoride	

EPA did not select the 8 pollutants of concern presented in Table 7-8 for proposed regulation in the metal-bearing subcategories because they may be used as treatment chemicals in the MP&M industry.

Table 7-8

Pollutants Not Selected for Proposed Regulation for the Metal-Bearing Subcategories Because They May Serve as Treatment Chemicals in the MP&M Industry

Nonconventional Metals	
Aluminum	Magnesium
Calcium	Sodium
Iron	
Other Nonconventional Pollutants	
Sulfate	Ziram
Chloride	

EPA eliminated the nonconventional metals listed in Table 7-8 plus sulfate and chloride from consideration because regulation of these pollutants could interfere with their beneficial use as wastewater treatment additives. In the case of ziram, EPA detected this pollutant at MP&M facilities that use sodium dimethyldithiocarbamate (DTC) as a reducing and precipitating agent in the treatment of complexed or chelated metals. For the MP&M proposal, EPA based the estimated costs and pollutant removals associated with the treatment of chelated or complexed metals on the use of DTC. When DTC is used appropriately, it may effectively enhance the removal of some difficult to treat pollutants without impacting the environment or POTW operations. However, DTC is toxic to aquatic life and to activated sludge and thus can upset POTW operations. DTC can combine to form, or break down to, a number of other toxic chemicals, including thiram and ziram (both EPA registered fungicides) and other thiurams, other dithiocarbamates, carbon disulfide, and dimethylamine. Ziram is known to be toxic to aquatic life at the following levels: LC 50 less than 10 ug/L (parts per billion) for several varieties of bluegill and trout; LC 50 between 10 and 100 ug/L in other studies (see AQUIRE database at <http://www.epa.gov/medecotx/quicksearch.htm>). EPA solicits comment in the proposal on the use of DTC for the treatment of chelated wastewater and its potential harmful effects on the environment and on POTW operations. As explained in the proposed rule, the Agency is particularly interested in receiving data and information on alternative treatments for wastewater containing chelated or complexed metals.

EPA did not select the 5 pollutants of concern presented in Table 7-9 for proposed regulation in the metal-bearing subcategories because they are not controlled by the selected BPT/BAT technology. EPA's analytical data showed that the proposed BPT/BAT treatment option did not effectively remove the low levels of ammonia as nitrogen or the low levels of Total Kjeldahl Nitrogen present in MP&M wastewater. As shown in Table 5-14, the median ammonia concentration at the influent to treatment was only 2.56 mg/L and treatment systems sampled by EPA achieved on average less than 20 percent removal. Similarly, the proposed BPT/BAT treatment systems sampled by EPA

did not demonstrate effective removal of boron, total phosphorous, or Total Dissolved Solids and only demonstrated incidental removal of boron.

Table 7-9

Pollutants Not Selected for Proposed Regulation for the Metal-Bearing Subcategories Because They Are Not Controlled by the Selected BPT/BAT Technology

Other Nonconventional Pollutants	
Ammonia as Nitrogen	Total Kjeldahl Nitrogen
Total Dissolved Solids	Total Phosphorous
Nonconventional Metal Pollutant	
Boron	

EPA considered proposing limits for all of the priority and nonconventional organic pollutants listed in Table 7-10; however, due to the variety of organic pollutants used across MP&M facilities, EPA determined that it would be burdensome to facilities and permit writers/control authorities have to determine which limits to apply to a facility. Instead, EPA is proposing an approach similar to the one used in the Metal Finishing Effluent Guidelines (40 CFR Part 433). EPA developed a list of organic pollutants, called the Total Organics Parameter (TOP), using the list of organic priority pollutants and other nonconventional organic pollutants that met EPA's pollutant of concern criteria for this rule. Of the nonconventional organic chemicals on the MP&M pollutant of concern list, EPA included only those that were removed in appreciable quantities by the selected technology option (based on toxic weighted pound-equivalents) in two or more subcategories. The TOP list is comprised of all of the priority and nonconventional organic pollutants listed in Table 7-10.

Table 7-10

64 Remaining Pollutants Considered for Proposed Regulation for the Metal-Bearing Subcategories

Priority Metals	
Cadmium	Lead
Chromium	Nickel
Copper	Silver
Cyanide	Zinc
Nonconventional Metals	
Manganese	Tin
Molybdenum	
Conventional Pollutants	
Oil and Grease (as HEM)	Total Suspended Solids
Other Nonconventional Pollutants	
Amenable Cyanide	Total Sulfide
Total Organic Carbon	
Priority Organic Pollutants	
1,1,1-Trichloroethane	Di-n-Butyl Phthalate
1,1-Dichloroethane	Di-n-Octyl Phthalate
1,1-Dichloroethylene	Dimethyl Phthalate
2,4-Dimethylphenol	Ethylbenzene
2,4-Dinitrophenol	Fluoranthene
2,6-Dinitrotoluene	Fluorene
2-Nitrophenol	Isophorone
4-Chloro-m-cresol	Methylene Chloride
4-Nitrophenol	n-Nitrosodimethylamine
Acenaphthene	n-Nitrosodiphenylamine
Acrolein	Naphthalene
Anthracene	Phenanthrene
Benzyl Butyl Phthalate	Phenol
Bis(2-Ethylhexyl) Phthalate	Pyrene
Chlorobenzene	Tetrachloroethene
Chloroethane	Toluene
Chloroform	Trichloroethylene
1-Methylfluorene	Biphenyl
1-Methylphenanthrene	Carbon Disulfide
2-Isopropyl-naphthalene	Dibenzofuran
2-Methylnaphthalene	Dibenzothiophene

Table 7-10 (Continued)

Nonconventional Organic Pollutants	
3,6-Dimethylphenanthrene	n-Hexadecane
Aniline	n-Tetradecane
Benzoic Acid	p-Cymene

EPA has derived the numerical limit for TOP based on the contribution of each of the organic pollutants listed in Table 7-10 using the data collected during sampling and determined the limitation using the same statistical methodology used for other limits developed for this proposal (see Table 10-7 for the list of TOP pollutants). In any case where the data for these pollutants indicated a level below the minimum level (ML) (i.e., below quantitation), EPA used the ML for the specific pollutant in the summation of the TOP limit. Facilities will only have to monitor for those TOP chemicals that are reasonably present (see Section 15.2.6 for a discussion on monitoring waivers). Note that the TOP limit shall not be adjusted for those pollutants that are not reasonably present. In the proposal, EPA solicits comment on this methodology.

As discussed above, EPA is also proposing to allow the use of an indicator parameter to measure the presence of organic pollutants in MP&M process wastewater. Facilities can monitor for the organic pollutants specified in the TOP list to demonstrate compliance with the TOP limit or they can monitor for Total Organic Carbon (TOC) and meet the TOC limit.

Finally, EPA is proposing a third alternative to reduce monitoring burden – the use of an organic pollutant management plan. The organic pollutant management plan would need to specify the following, to the satisfaction of the permitting authority or control authority:

- Ⓒ The toxic and non-conventional organic constituents used at the facility;
- Ⓒ The disposal method used;
- Ⓒ The procedures in place for ensuring that organic pollutants do not routinely spill or leak into the wastewater or that minimize the amount of organic pollutants used in the process;
- Ⓒ The procedures in place to manage the oxidation reduction potential (ORP) during cyanide destruction to control the formation of chlorinated organic byproducts; and
- Ⓒ The procedures to prevent the over dosage of dithiocarbamates when treating chelated wastewater.

Facilities choosing to develop an organic pollutant management plan would need to certify that the procedures described in the plan are being implemented at the facility. Section 15.2.6 explains the organic management plan in greater detail.

In order to determine the pollutants proposed for regulation for each of the metal-bearing subcategories, EPA considered each of the remaining pollutants in Table 7-10 on a subcategory-by-subcategory basis. That is, after eliminating the pollutants listed in Tables 7-6 through 7-9 by analyzing all of the data for the metal-bearing subcategories combined, EPA then considered only data from each individual subcategory in order to determine the proposed regulated pollutants for each subcategory.

7.2.1.1 General Metals Subcategory

For the direct dischargers in the General Metals subcategory, EPA proposed regulations for all of the pollutants listed in Table 7-10. For the organic parameters listed in Table 7-9, facilities in this subcategory may choose from the following three options in order to comply with the regulation: comply with the limit for TOC; comply with the limit for TOP; or implement an organic pollutant management plan. Section 14 lists the effluent limitations for direct dischargers in the General Metals subcategory.

7.2.1.2 Metal Finishing Job Shops Subcategory

For the direct dischargers in the Metal Finishing Job Shops subcategory, EPA proposed regulations for all of the pollutants listed in Table 7-10. For the organic parameters listed in Table 7-10, facilities in this subcategory may choose from the following three options in order to comply with the regulation: comply with the limit for TOC; comply with the limit for TOP; or implement an organic pollutant management plan. Section 14 lists the effluent limitations for direct dischargers in the Metal Finishing Job Shops subcategory.

7.2.1.3 Non-Chromium Anodizing Subcategory

For the direct dischargers in the Non-Chromium Anodizing subcategory, EPA proposed regulations for TSS, O&G, aluminum, manganese, nickel, and zinc. Although EPA had eliminated aluminum from consideration for regulation for the metal-bearing subcategories because of its use as a treatment chemical, EPA decided to propose limits for aluminum for direct dischargers in this subcategory because of the large amount of aluminum discharged by non-chromium anodizing facilities. (See Section 6.6.3 for a description of the Non-Chromium Anodizing subcategory.) EPA also determined that unit operations performed at non-chromium anodizing facilities may generate wastewater containing significant quantities of manganese, nickel, and zinc and is proposing effluent limitations for these three metals. The Agency did not identify a large number of organic pollutants in wastewater from non-chromium anodizing operations and therefore did not propose a TOC or TOP limit for these dischargers. It did, however, propose a limit for O&G to control the discharge of this

pollutant into surface water. Section 14 lists the effluent limitations for direct dischargers in the Non-Chromium Anodizing subcategory.

7.2.1.4 Printed Wiring Board Subcategory

For the direct dischargers in the Printed Wiring Board subcategory, EPA is proposing regulations for all of the pollutants listed in Table 7-10 except cadmium, molybdenum and silver. These three metals were not found at significant concentrations at facilities in the this subcategory. For the organic parameters listed in Table 7-10, facilities in the Printed Wiring Board subcategory may choose from the following three options in order to comply with the regulation: comply with the limit for TOC; comply with the limit for TOP; or implement an organic pollutant management plan. Section 14 lists the effluent limitations for direct dischargers in the Printed Wiring Board subcategory.

7.2.1.5 Steel Forming and Finishing Subcategory

For the direct dischargers in the Steel Forming and Finishing subcategory, EPA proposed regulations for all of the pollutants listed in Table 7-10. For the organic parameters listed in Table 7-10, facilities in this subcategory may choose from the following three options in order to comply with the regulation: comply with the limit for TOC; comply with the limit for TOP; or implement an organic pollutant management plan. Section 14 lists the effluent limitations for direct dischargers in the Steel Forming and Finishing subcategory.

7.2.2 Regulated Pollutant Analysis for Direct Dischargers in the Oil-Bearing Subcategories

As mentioned in Section 7.2, EPA determined that the following subcategories generate oil-bearing wastewater: Oily Wastes, Railroad Line Maintenance, and Shipbuilding Dry Docks. This section describes EPA's proposed regulated pollutant selection criteria for direct dischargers in the oil-bearing subcategories.

EPA did not select the 39 pollutants of concern presented in Table 7-11 that are controlled through the regulation of other pollutants in the oil-bearing subcategories.

Table 7-11

**Pollutants Not Selected for Proposed Regulation for the Oil-Bearing
Subcategories Because They Are Controlled Through the Regulation of
Other Pollutants**

Other Nonconventional Pollutants	
COD	Total Recoverable Phenolics
Total Petroleum Hydrocarbons (as SGT-HEM)	
Nonconventional Organic Pollutants	
1,4-Dioxane	n-Decane
1-Bromo-2-Chlorobenzene	n-Docosane
1-Bromo-3-Chlorobenzene	n-Dodecane
2-Butanone	n-Eicosane
2-Hexanone	n-Hexacosane
2-Propanone	n-Nitrosopiperidine
4-Methyl-2-Pentanone	n-Octacosane
Acetophenone	n-Octadecane
Alpha-Terpineol	n-Tetracosane
Benzyl Alcohol	n-Triacontane
Diphenyl Ether	o+p Xylene
Diphenylamine	o-Cresol
Hexanoic Acid	o-Xylene
Isobutyl Alcohol	p-Cresol
m+p Xylene	Pyridine
m-Xylene	Styrene
Methyl Methacrylate	Trichlorofluoromethane
n,n-Dimethylformamide	Tripropyleneglycol Methyl Ether

COD is a method for measuring the oxygen demand of wastewater. For the oil-bearing subcategories, EPA did not select COD for proposed regulation, but instead is proposing alternative parameters for measuring the oxygen demand of a wastewater. For the Oily Wastes subcategory, EPA is proposing a limit for Total Organic Carbon (TOC), an alternate method that measures all oxidizable organic material in a waste stream, including some organic chemicals not oxidized (and, therefore not detected) in the COD test. EPA chose TOC as an indicator parameter because of its ability to measure all types of organic pollutants and is found to be the best general indicator parameter for measuring the sum of organic compounds in an MP&M waste stream. For the Railroad Line Maintenance subcategory, EPA is proposing limitations for BOD₅ rather than COD, and for the Shipbuilding Dry Dock subcategory it has determined that the regulation of only O&G was necessary to control the removal of organic constituents.

EPA did not propose a limit for Total Petroleum Hydrocarbons (TPH) (as SGT-HEM) because it believes that the regulation of O&G (as HEM) and EPA's proposed organics control options will control the discharge of TPH (as SGT-HEM). The parameter Total Recoverable Phenolics will be controlled through the regulation of the Total Organics Parameter (TOP) which includes compounds such as phenol. EPA also believes that the list of 36 nonconventional organic compounds listed in Table 7-11 will be controlled through the regulation of TOP. The organic parameters that comprise the TOP are explained in more detail later in this section.

Table 7-12 presents 28 pollutants of concerns that are present in only trace amounts in the oil-bearing subcategories and/or are not likely to cause toxic effects. EPA determined that it was not necessary to propose limits for these metals listed because it detected these metals at low levels in its sampling of oil-bearing wastewater. As shown in Table 5-10, the average concentration at the influent to treatment for each of these metals is less than 0.1 mg/L.

Table 7-12

Pollutants Not Selected for Proposed Regulation for the Oil-Bearing Subcategories Because They Are Present in Only Trace Amounts and/or Are Not Likely to Cause Toxic Effects

Priority Metals	
Antimony	Cyanide
Arsenic	Mercury
Beryllium	Nickel
Cadmium	Selenium
Chromium	Silver
Copper	Thallium

Table 7-12 (Continued)

Nonconventional Metals	
Cobalt	Titanium
Gold	Vanadium
Molybdenum	Yttrium
Tin	
Nonconventional Organic	
Carbon Disulfide	
Other Nonconventional Pollutants	
Amenable Cyanide	Total Dissolved Solids
Ammonia as Nitrogen	Total Kjeldahl Nitrogen
Fluoride	Weak-Acid Dissociable Cyanide
Hexavalent Chromium	Ziram

EPA did not select the 7 pollutants of concern presented in Table 7-13 for proposed regulation in the oil-bearing subcategories because they may be used as treatment chemicals in the MP&M industry.

Table 7-13

Pollutants Not Selected for Proposed Regulation for the Oil-Bearing Subcategories Because They May Serve as Treatment Chemicals in the MP&M Industry

Nonconventional Metals	
Aluminum	Magnesium
Calcium	Sodium
Iron	
Other Nonconventional Pollutants	
Chloride	Sulfate

EPA did not select the 6 pollutants of concern presented in Table 7-14 for proposed regulation in the oil-bearing subcategories because they are not controlled by the selected BPT/BAT technology.

Table 7-14

Pollutants Not Selected for Proposed Regulation for the Oil-Bearing Subcategories Because They Are Not Controlled by the Selected BPT/BAT Technology

Priority Metal Pollutants	
Lead	Zinc
Nonconventional Metal Pollutants	
Barium	Manganese
Boron	
Other Nonconventional Pollutant	
Total Phosphorous	

In order to determine the pollutants proposed for regulation for each of the oil-bearing subcategories, EPA considered each of the remaining pollutants in Table 7-15 on a subcategory-by-subcategory basis. That is, after eliminating the pollutants listed in Tables 7-11 through 7-14 by analyzing all of the data for the oil-bearing subcategories combined, EPA then considered only data from each individual subcategory in order to determine the proposed regulated pollutants for each subcategory.

Table 7-15

49 Remaining Pollutants Considered for Proposed Regulation for the Oil-Bearing Subcategories

Conventional Pollutants	
BOD ₅	Total Suspended Solids
Oil and Grease	
Other Nonconventional Pollutants	
Total Organic Carbon	Total Sulfide
Priority Organic Pollutants	
1,1,1-Trichloroethane	Di-n-Butyl Phthalate
1,1-Dichloroethane	Di-n-Octyl Phthalate
1,1-Dichloroethylene	Dimethyl Phthalate
2,4-Dimethylphenol	Ethylbenzene
2,4-Dinitrophenol	Fluoranthene

Table 7-15 (Continued)

2,6-Dinitrotoluene	Fluorene
2-Nitrophenol	Isophorone
4-Chloro-m-cresol	Methylene Chloride
Priority Organic Pollutants (continued)	
4-Nitrophenol	n-Nitrosodimethylamine
Acenaphthene	n-Nitrosodiphenylamine
Acrolein	Naphthalene
Anthracene	Phenanthrene
Benzyl Butyl Phthalate	Phenol
Bis(2-Ethylhexyl) Phthalate	Pyrene
Chlorobenzene	Tetrachloroethene
Chloroethane	Toluene
Chloroform	Trichloroethylene
Nonconventional Organic Pollutants	
1-Methylfluorene	Biphenyl
1-Methylphenanthrene	Carbon Disulfide
2-Isopropyl-naphthalene	Dibenzofuran
2-Methylnaphthalene	Dibenzothiophene
3,6-Dimethylphenanthrene	n-Hexadecane
Aniline	n-Tetradecane
Benzoic Acid	p-Cymene

7.2.2.1 Oily Wastes Subcategory

For the direct dischargers in the Oily Wastes subcategory, EPA is proposing effluent limitations for all of the pollutants listed in Table 7-15 except for BOD₅. EPA is proposing an effluent limitation for O&G and TOC for this subcategory and therefore determined that BOD₅ would be controlled by the regulation of these parameters. For the organic parameters listed in Table 7-14, facilities in the Oily Wastes subcategory may choose from the following three options in order to comply with the regulation: comply with the limit for TOC; comply with the limit for TOP; or implement an organic pollutant management plan. Section 14 lists the effluent limitations for direct dischargers in the Oily Wastes subcategory.

7.2.2.2 Railroad Line Maintenance Subcategory

For the direct dischargers in the Railroad Line Maintenance subcategory, EPA is proposing effluent limitations for all of the pollutants listed in Table 7-15 except for TOC, total sulfide, and all of the priority and nonconventional pollutants (represented as TOP). EPA is proposing effluent limitations for O&G and BOD₅ for this subcategory and therefore determined that TOC and the priority and nonconventional organic pollutants would be controlled by the regulation of these parameters. EPA is not proposing an effluent limit for total sulfide in this subcategory because of the small quantity of this pollutant removed by proposed technology. EPA estimates that the regulation of total sulfide for the Railroad Line Maintenance subcategory would result in the removal of 7.3 lbs/year or less than 0.2 lbs/facility. Section 14 lists the effluent limitations for the direct dischargers in the Railroad Line Maintenance subcategory.

7.2.2.3 Shipbuilding Dry Dock Subcategory

For the direct dischargers in the Shipbuilding Dry Dock subcategory, EPA is proposing effluent limitations for all of the pollutants listed in Table 7-15 except for BOD₅, TOC, total sulfide, and all of the priority and nonconventional pollutants (represented as TOP). EPA is proposing effluent limitations for O&G for this subcategory and therefore determined that BOD₅, TOC, and the priority and nonconventional organic pollutants would be controlled by the regulation of O&G. EPA is not proposing an effluent limit for total sulfide in this subcategory because of the small quantity of this pollutant removed by the proposed technology. Many of the facilities in this subcategory already have treatment in place, and therefore, the MP&m rule achieves very little additional removal of total sulfide. EPA estimates that the regulation of total sulfide for the Shipbuilding Dry Dock subcategory would result in the removal of less than 1 lb/yr. Section 14 lists the effluent limitations for the direct dischargers in the Shipbuilding Dry Dock subcategory.

7.3 Pollutants Proposed to be Regulated for Indirect Dischargers

For indirect dischargers, before proposing national technology-based pretreatment standards, EPA examines whether the pollutants discharged by an industry “pass through” POTWs to waters of the U.S. or interfere with POTW operation or sludge disposal practices. Section 307(b) of the CWA requires EPA to promulgate pretreatment standards for existing sources (PSES) and new sources (PSNS). The Agency establishes pretreatment standards to ensure removal of pollutants that pass through or interfere with POTWs. EPA evaluated POTW pass-through for the MP&M pollutant parameters of concern listed in Tables 7-10 and 7-15.

Sections 7.3.2 and 7.3.3 discuss the results of the pass-through analysis for existing and new sources, respectively.

7.3.1 Pass-through Analysis for Indirect Dischargers

Generally, to determine if pollutants pass through POTWs, EPA compares the percentage of the pollutant removed by well-operated POTWs achieving secondary treatment with the percentage of the pollutant removed by direct discharging industrial facilities applying BAT for that pollutant. The Agency determines that a pollutant “passes through” the POTW when the average percentage removed by POTWs nationwide is less than the percentage removed by direct discharging industrial facilities applying the BAT technology basis. In this manner, EPA can ensure that the combined treatment at indirect discharging facilities and POTWs is at least equivalent to that obtained through treatment by a direct discharger using BAT technology.

EPA compares removals for two reasons: (1) to ensure that wastewater treatment performance for indirect dischargers is equivalent to that for direct dischargers, and (2) to recognize and take into account the treatment capability and performance of the POTW in regulating the discharge of pollutants from indirect dischargers. Rather than compare the mass or concentration of pollutants discharged by POTWs with the mass or concentration of pollutants discharged by BAT facilities, EPA compares the percentage of the pollutants removed by BAT facilities to the POTW removals. EPA takes this approach because a comparison of the mass or concentration of pollutants in POTW effluents with pollutants in BAT facility effluents would not take into account the mass of pollutants discharged to the POTW from other industrial and non-industrial sources, nor the dilution of the pollutants in the POTW to lower concentrations from the addition of large amounts of other industrial and non-industrial water.

EPA conducted the pass through removal comparison on the priority and nonconventional metal pollutants regulated under BAT for each subcategory. The Agency did not perform this assessment for the regulated conventional pollutants, namely BOD₅, TSS, and O&G, since the conventional pollutants are generally not regulated under PSES and PSNS. EPA also did not perform the pass through analysis for the priority and nonconventional organic pollutants that comprise the TOP nor did it perform the analysis for TOC. Since EPA is proposing limitations for TOP and TOC as part of an organic indicator option for direct dischargers, the Agency also decided that it was appropriate to propose the same organic indicator alternatives for indirect dischargers. Similarly, the Agency did not perform the pass-through analysis for amenable cyanide. EPA is proposing a limit for direct dischargers for amenable cyanide as an alternative to total cyanide as a way to provide monitoring flexibility. The Agency decided that it was appropriate to propose the same cyanide monitoring alternatives for indirect dischargers as those proposed for direct, and therefore, it did not perform the pass-through analysis for amenable cyanide.

The primary source of the POTW percent removal data is the “Fate of Priority Pollutants in Publicly Owned Treatment Works” (EPA 440/1-82/303, September 1982), commonly referred to as the “50-POTW Study.” This study presents data on the performance of 50 well-operated POTWs that employ secondary biological treatment in removing pollutants. Each sample was analyzed for three conventional, 16 non-conventional, and 126 priority toxic pollutants. EPA used

percent removals data from the 50-POTW Study for all of the pollutants for which EPA applied the pass-through analysis (i.e., those pollutants proposed for regulation at BAT).

In using the 50-POTW Study data to estimate percent removals, EPA has established data editing criteria for determining pollutant percent removals. Some of the editing criteria are based on differences between POTW and industry BAT treatment system influent concentrations. For many toxic pollutants, POTW influent concentrations were much lower than those of BAT treatment systems. For many pollutants, particularly organic pollutants, the effluent concentrations from both POTW and BAT treatment systems were below the level that could be found or measured. As noted in the 50-POTW Study, analytical laboratories reported pollutant concentrations below the analytical threshold level, qualitatively, as “not detected” or “trace,” and reported a measured value above this level. Subsequent rulemaking studies such as the 1987 OCPSF study used the analytical method nominal minimum level (ML) established in 40 CFR Part 136 for laboratory data reported below the analytical threshold level. Use of the nominal ML may overestimate the effluent concentration and underestimate the percent removal.

At the time of the 50-POTW sampling program, which spanned approximately 2.5 years (July 1978 to November 1980), EPA collected samples at selected POTWs across the U.S. The samples were subsequently analyzed by either EPA or EPA-contract laboratories using test procedures (analytical methods) specified by the Agency or in use at the laboratories. Laboratories typically reported the analytical method used along with the test results. However, for those cases in which the laboratory specified no analytical method, EPA was able to identify the method based on the nature of the results and knowledge of the methods available at the time.

Each laboratory reported results for the pollutants for which it tested. If the laboratory found a pollutant to be present, the laboratory reported a result. If the laboratory found the pollutant not to be present, the laboratory reported either that the pollutant was “not detected” or a value with a “less than” sign (<) indicating that the pollutant was below that value. The value reported along with the “less than” sign was the lowest level to which the laboratory believed it could reliably measure. EPA subsequently established these lower levels as the MLs of quantitation. In some instances, different laboratories reported different (sample-specific) MLs for the same pollutant using the same analytical method.

Because of the variety of reporting protocols among the 50-POTW Study laboratories (pages 27 to 30, 50-POTW Study), EPA reviewed the percent removal calculations used in the pass-through analysis for previous industry studies, including those performed when developing effluent guidelines for Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) Manufacturing, Centralized Waste Treatment (CWT), and Commercial Hazardous Waste Combustors. EPA found that, for 12 parameters, different analytical MLs were reported for different rulemaking studies (10 of the 21 metals, cyanide, and one of the 41 organics).

To provide consistency for data analysis and establishment of removal efficiencies, EPA reviewed the 50-POTW Study, standardized the reported MLs for use in the final rules for CWT and Transportation Equipment Cleaning Industries and for this proposed rule and the Iron and Steel proposed rule. A more detailed discussion of the methodology used and the results of the ML evaluation are contained in the MP&M public record.

Because the data collected for evaluating POTW percent removals included both effluent and influent levels that were close to the analytical detection levels, EPA devised hierarchical data editing criteria to exclude data with low influent concentration levels, thereby minimizing the possibility that low POTW removals might simply reflect low influent concentrations instead of being a true measure of treatment effectiveness.

EPA has generally used hierarchic data editing criteria for the pollutants in the 50-POTW Study. For the MP&M proposal, as in previous rulemakings, EPA used the following editing criteria:

- 1) Delete both influent and effluent data on a given date if either datum has a notation of analytical interference;
- 2) Substitute a pollutant-specific analytical “minimum level” for values “reported as “not detected,” “trace,” “less than [followed by a number],” or a number” less than the analytical minimum level established by the reporting laboratory;
- 3) Delete pollutants that have fewer than three pairs of data points (influent/effluent);
- 4) Delete pollutant influent and corresponding effluent values if the average pollutant influent level is less than 10 times the pollutant minimum level; and
- 5) If none of the average pollutant influent concentrations exceeded 10 times the ML, then delete average influent values less than 20 : g/l or twice the ML (2XML) along with the corresponding average effluent values.

EPA then calculates each POTW percent removal for each pollutant based on its average influent and its average effluent values. The national POTW percent removal used for each pollutant in the pass-through test is the median value of all the POTW pollutant specific percent removals.

The rationale for retaining POTW data using the “10xML” editing criterion is based on the BAT organic pollutant treatment performance editing criteria initially developed for the 1987 OCPSF regulation (52 FR 42522, 42545-48; November 5, 1987). BAT treatment system designs in the OCPSF industry typically achieved at least 90 percent removal of toxic pollutants. Since most of the OCPSF effluent data from BAT biological treatment systems had values of “not detected,” the average influent concentration for a compound had to be at least 10 times the analytical minimum level

for the difference to be meaningful (demonstration of at least 90 percent removal) and qualify effluent concentrations for calculation of effluent limits.

EPA is evaluating several issues related to its traditional methodology for determining POTW performance and explains these issues in detail in Appendix A to this Section.

7.3.2 Pass-through Analysis Results for Existing Sources

For each of the MP&M subcategories, EPA calculated the percentage of a pollutant removed by BAT treatment systems using the median percent removal achieved by BAT facilities that it used for determining effluent limitations for direct dischargers. To determine pass-through, it compared this median percent removal for BAT facilities to the median percent removal determined from the 50-POTW database. Table 7-16 presents the results of the pass-through analysis for the metal-bearing wastewater subcategories.

Table 7-16

Pass-Through Analysis Results for Existing Sources for Metal-Bearing Wastewater Subcategories

Pollutant	Median BAT Percent Removal by Subcategory					Median POTW Percent Removal (c)
	General Metals	Metal Finishing Job Shops	Non-Chromium Anodizing	Printed Wiring Boards	Steel Forming and Finishing (b)	
Amenable Cyanide (a)	99.6	99.6	NA	99.6	99.6	57.4
Cadmium	92.2	98.8	NA	NA	92.2	90.1
Chromium	99	96.7	NA	99.0 (b)	99	80.3
Copper	95.8	95.9	NA	96.3	95.8	84.2
Cyanide (a)	99.1	99.1	NA	99.1	99.1	70.4
Lead	99.4	99.6	NA	99.4 (b)	99.4	77.5
Manganese	96.9	98.8	96.9 (b)	57.7	96.9	35.5
Molybdenum	64.7	64.7 (b)	NA	NA	64.7	18.9
Nickel	96.3	93.7	96.3 (b)	89.3	96.3	51.4
Silver	94.8	96.5	NA	NA	94.8	88.3
Tin	98.8	97.8	NA	98.1	98.8	42.6
Zinc	98	97.1	98.0 (b)	98.0 (b)	98	79.1

(a) EPA determined BAT percent removals for Total Cyanide using data from all subcategories.

(b) EPA transferred BAT percent removal from General Metals Subcategory.

(c) All POTW percent removals determined from 50-POTW Study.

NA = Pollutant not proposed for BAT regulation for the specific subcategory therefore pass through analysis does not apply.

EPA compared the BAT percent removals and the POTW percent removals shown in Table 7-16 and determined that all of these pollutants pass through POTWs. In addition to the pollutants listed in Table 7-16, EPA is proposing pretreatment standards for Total Sulfide for the General Metals, Metal Finishing Job Shops, Printed Wiring Board, and Steel Forming and Finishing subcategories. The Agency is proposing a limitation for total sulfide based on potential POTW interference or upset associated with discharges of this pollutant from MP&M facilities (i.e., through corrosion of pipes from formatting sulfuric acid or hazardous conditions to POTW employees from generation of hydrogen sulfide gas). EPA is also proposing pretreatment standards for TOC and TOP as part of a compliance alternative for organic pollutant discharges. See Section 15.2.6 for a discussion of the proposed monitoring alternatives for organic pollutants. Section 14 lists the pretreatment standards for the pollutants proposed for regulation for indirect dischargers in each of the subcategories.

For the three subcategories that generate primarily oil-bearing wastewater (Oily Wastes, Railroad Line Maintenance, and Shipbuilding Dry Dock), EPA is only establishing pretreatment standards for the Oily Wastes subcategory. For the reasons discussed in detail in Section 14, EPA is not proposing pretreatment standards for the Railroad Line Maintenance nor the Shipbuilding Dry Dock subcategories. For the Oily Wastes subcategory, EPA is proposing pretreatment standards for TOP, TOC and total sulfide. The Agency is proposing a limitation for total sulfide based on potential POTW interference or upset associated with discharges of this pollutant from MP&M facilities. EPA is also proposing pretreatment standards for TOC and TOP as part of a compliance alternative for organic pollutant discharges. See Section 15.2.6 for a discussion of the proposed monitoring alternatives for organic pollutants. Section 14 lists the pretreatment standards for the pollutants proposed for regulation for indirect dischargers in the Oily Wastes subcategory.

7.3.3 Pass-through Analysis Results for New Sources

For each of the MP&M subcategories, EPA calculated the percentage of a pollutant removed by NSPS treatment systems using the median percent removal achieved by NSPS facilities that it used for determining effluent limitations for new direct dischargers. To determine pass-through, it compared this median percent removal for NSPS facilities to the median percent removal determined from the 50-POTW database. Table 7-17 presents the results of the pass-through analysis for the metal-bearing wastewater subcategories:

Table 7-17

**Pass-Through Analysis Results for New Sources for Metal-Bearing
Wastewater Subcategories**

Pollutant	Median NSPS Percent Removal by Subcategory					Median POTW Percent Removal (c)
	General Metals	Metal Finishing Job Shops	Non-Chromium Anodizing (d)	Printed Wiring Boards	Steel Forming and Finishing (d)	
Cadmium	99.8	99.8 (d)	NA	NA	99.8	90.1
Chromium	99.4	99.4 (d)	NA	99.4 (d)	99.4	80.3
Copper	97.8	97.8 (d)	NA	100	97.8	84.2
Cyanide (a)	99.1	99.1	NA	99.1	99.1	70.4
Lead	99.4 (b)	99.4 (b)	NA	99.1	99.4	77.5
Manganese	96.3	96.3 (d)	96.9 (b)	96.3 (d)	96.3	35.5
Molybdenum	64.7 (b)	64.7 (b)	NA	NA	64.7	18.9
Nickel	97.6	97.6 (d)	96.3 (b)	97.6 (d)	97.6	51.4
Silver	99.4	99.4 (d)	NA	NA	99.4	88.3
Tin	98.5	98.5 (d)	NA	98.9	98.5	42.6
Zinc	99.8	99.8 (d)	98.0 (b)	99.8 (d)	99.8	79.1

(a) EPA determined NSPS percent removals for Total Cyanide using data from all subcategories.

(b) EPA transferred BAT percent removal from General Metals Subcategory.

(c) All POTW percent removals determined from 50-POTW Study.

(d) EPA transferred NSPS percent removals from General Metals subcategory.

NA = Pollutant not proposed for NSPS regulation for the specific subcategory therefore pass through analysis does not apply.

EPA compared the NSPS percent removals and the POTW percent removals shown in Table 7-17 and determined that all of these pollutants pass through POTWs. In addition to the pollutants listed in Table 7-17, EPA is proposing pretreatment standards for new sources for Total Sulfide for the General Metals, Metal Finishing Job Shops, Printed Wiring Board, and Steel Forming and Finishing subcategories. The Agency is proposing a limitation for total sulfide based on potential POTW interference or upset associated with discharges of this pollutant from MP&M facilities (i.e., through corrosion of pipes from formation of sulfuric acid or hazardous conditions to POTW employees from generation of hydrogen sulfide gas). EPA is also proposing pretreatment standards for new sources for TOC and TOP as part of a compliance alternative for organic pollutant discharges. See Section 15.2.6 for a discussion of the proposed monitoring alternatives for organic pollutants. Section

14 lists the pretreatment standards for new sources for the pollutants proposed for regulation for indirect dischargers in each of the subcategories.

For the reasons described in Section 14, EPA is proposing pretreatment standards for new sources (PSNS) for the Oily Wastes subcategory equivalent to those proposed for existing sources. In addition, the Agency also explains in Section 14 its rationale for not proposing PSNS for the Railroad Line Maintenance and the Shipbuilding Dry Docks subcategories.

7.4 References

1. U.S. Environmental Protection Agency. The 1990 Industrial Technology Division List of Analytes. Washington, DC, May 1990.
2. U.S. Environmental Protection Agency. Development Document for the Centralized Waste Treatment Industry, December 1998.
3. U.S. Environmental Protection Agency. Fate of Priority Pollutants in Publicly Owned Treatment Works, EPA-440/1-82/303. Washington DC, September 1982.

Appendix A

Proposed Revisions to the Methodology Used to Determine POTW Performance for Toxic and Non-Conventional Pollutants

For the MP&M proposal, EPA used its traditional methodology to determine POTW performance (percent removal) for toxic and non-conventional pollutants. POTW performance is a component of the pass-through methodology used to identify the pollutants to be regulated for PSES and PSNS. It is also a component of the analysis to determine net pollutant reductions (for both total pounds and toxic pound-equivalents) for various indirect discharge technology options. However, as discussed in more detail below, EPA is considering revisions to its traditional methodology for determining POTW performance (percent removals) for toxic and non-conventional pollutants. In the traditional methodology, the pertinent data selection editing criteria used to determine POTW percent removals were based on the editing criteria used for industry data to calculate BAT limitations. However, since POTWs are designed to treat conventional pollutants, not toxic pollutants, the revised editing criteria would more accurately reflect the incidental removals of toxic pollutants in POTWs.

Background

Unlike direct dischargers whose wastewater will receive no further treatment once it leaves the facility, indirect dischargers send their wastewater streams to POTWs for further treatment. However, POTWs typically install secondary biological treatment systems which are designed to control conventional pollutants [biochemical oxygen demand (BOD), total suspended solids (TSS), oil & grease (O&G), pH, and fecal coliform] -- the principal parameters for characterizing domestic sewage. With the exception of nutrient control for ammonia and phosphorus, POTWs usually do not install specific technology (advanced or tertiary treatment) to control toxic and non-conventional pollutants, although incidental removals in secondary biological treatment systems may be significant for some toxic pollutants. Instead, the Clean Water Act envisions that, through implementation of pretreatment programs and industrial compliance with categorical pretreatment standards, toxic and non-conventional pollutants in municipal effluents will be controlled adequately.

Therefore, for indirect dischargers, before proposing national technology-based pretreatment standards, EPA examines whether the pollutants discharged by an industry “pass through” POTWs to waters of the U.S. or interfere with POTW operation or sludge disposal practices. Generally, to determine if pollutants pass through POTWs, EPA compares the percentage of the pollutant removed by well-operated POTWs achieving secondary treatment with the percentage of the pollutant removed by direct discharging industrial facilities applying BAT for that pollutant. A pollutant is determined to “pass through” the POTW when the average percentage removed by POTWs nationwide is less than the percentage removed by direct discharging industrial facilities applying the BAT technology basis. In this manner, EPA can ensure that the combined treatment at indirect

discharging facilities and POTWs is at least equivalent to that obtained through treatment by a direct discharger using BAT technology.

For specific pollutants, such as volatile organic compounds, EPA may use other means to determine pass-through. These evaluations may include chemical and physical properties (e.g., Henry's Law constants, octanol/water partition coefficients, and water solubility constants) and empirical data to estimate amounts of volatilization, biodegradation, and/or partitioning to the residue solids phase.

Traditional Methodology for Determination of POTW Percent Removals

The primary source of the POTW data is the "Fate of Priority Pollutants in Publicly Owned Treatment Works" (EPA 440/1-82/303, September 1982), commonly referred to as the "50-POTW Study." At most of these POTWs, EPA collected a minimum of 6 days of 24-hour composite influent and effluent wastewater samples. EPA analyzed each sample for the conventional pollutants (excluding fecal coliform), selected non-conventional pollutants, and the 126 priority pollutants. The conventional pollutants, listed at 40 CFR 401.16, are BOD₅, TSS, O&G, pH, and fecal coliform. The selected non-conventional pollutants included chemical oxygen demand, total organic carbon, total phenols, ammonia nitrogen, iron, aluminum, and magnesium, among several others. The priority pollutants consist of the 126 compounds (listed in Appendix A of 40 CFR Part 423) that are a subset of the 65 toxic pollutants and classes of pollutants referred to in Section 307(a) of the Clean Water Act and listed at 40 CFR 401.15. A total of 102 of the 126 priority toxic pollutants were detected at least once in POTW influents (page 1, 50-POTW Study).

In using the 50-POTW Study data to estimate percent removals, EPA established data editing criteria for determining pollutant percent removals. Some of the editing criteria are based on differences between POTW and industry BAT treatment system influent concentrations. For many pollutants, POTW influent concentrations were much lower than those of BAT treatment systems. For many pollutants, particularly organic pollutants, the effluent concentrations from both POTW and BAT treatment systems, were below the level that could be found or measured. As noted in the 1982 50-POTW Study, analytical laboratories reported pollutant concentrations below the analytical minimum level, qualitatively, as "not detected" or "trace," and reported a measured value above this level (pages 27 to 30). Subsequent rulemaking studies such as the 1987 OCPSF study used the analytical method "minimum level" (ML) established in 40 CFR Part 136 for laboratory data reported below the analytical threshold level. Use of the ML may overestimate the effluent concentration and underestimate the percent removal. (If the actual effluent concentration is less than the ML, then the calculated percent removal based on the actual value would be higher.) Because the data collected for evaluating POTW percent removals included both effluent and influent levels that were close to the analytical MLs, EPA devised hierarchical data editing criteria to exclude data with low influent concentration levels, thereby minimizing the possibility that low POTW removals might simply reflect low influent concentrations instead of being a true measure of treatment effectiveness.

EPA has generally used the following hierarchic data editing criteria¹ for the pollutants in the 50-POTW Study:

- 1) Delete both influent and effluent data on a given date if either datum has a notation of analytical interference,
- 2) Substitute a pollutant-specific analytical “minimum level” for values reported as “not detected”, “trace”, “less than [followed by a number]”, or a number less than the analytical minimum level established by the reporting laboratory,
- 3) Delete pollutants that have fewer than three pairs of data points (influent/effluent),
- 4) Delete pollutant influent and corresponding effluent values if the average pollutant influent level is less than 10 times the pollutant ML, and
- 5) If none of the average pollutant influent concentrations exceeded 10xML, then delete average influent values less than 20 : g/l or twice the minimum level (2xML) along with the corresponding average effluent values.

EPA then calculated each POTW percent removal for each pollutant based on its average influent and its average effluent values. The POTW percent removal used for each pollutant in the pass-through test was the median value of all the POTW pollutant specific percent removals.

The rationale for retaining POTW data using the “10 times the pollutant minimum level” editing criterion was based on the BAT organic pollutant treatment performance editing criteria initially developed for the 1987 organic chemicals, plastics, and synthetic fibers (OCPSF) regulation (40 CFR Part 414; 52 FR 42522 at 42545 to 48). BAT treatment system designs in the OCPSF industry typically achieved at least 90 percent removal of toxic pollutants. Since most of the OCPSF effluent data from BAT biological treatment systems had values of “not detected,”² the average influent concentration for a compound had to be at least 10 times the analytical ML for the difference to be meaningful (demonstration of at least 90 percent removal) and qualify effluent concentrations for calculation of effluent limits (“OCPSF DD,” Vol. I, page VII-183).

¹ These 50-POTW Study data editing criteria may vary among effluent guideline development studies.

² Of the 57 regulated organic pollutants, limits for 34 (60 percent) were based on long-term averages of “not detected” or the analytical minimum level (“Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Point source Category” – the “OCPSF DD,” (EPA 440/1-87/009), October 1987, Vol. I, pages VII-208 to VII-210).

Review of the 50-POTW Study Analytical Laboratory Reporting Practices and Standardization of Minimum Level Values

At the time of the 50-POTW sampling program which spanned approximately 2 ½ years (July 1978 to November 1980), EPA collected samples at selected POTWs across the U.S. The samples were subsequently analyzed by either EPA or EPA-contract laboratories using test procedures (analytical methods) specified by the Agency or in use at the laboratories. Laboratories typically reported the analytical method used along with the test results. However, for those cases in which the laboratory specified no analytical method, EPA was able to specify the method based on the nature of the results and knowledge of the methods available at the time.

To provide consistency for data analysis and establishment of removal efficiencies, EPA reviewed the 50-POTW Study, standardized the reported MLs for use in the CWT final rule and the MP&M proposal. EPA standardized the MLs based on information about the analytical methods used, laboratory capabilities at the time the testing was conducted (1978 to 1980), MLs that had been achievable historically, and consultation with Agency experts in the field of analytical chemistry. The standardized MLs are used in this reassessment.

Reassessment of the Pass-Through Methodology and Revised Editing Criteria

The Agency has reevaluated several aspects of the 50-POTW Study data base editing process and is considering changes to the editing criteria. Several minor editing criteria changes that EPA is considering for use in the final MP&M pretreatment standard including those related to the presence of analytical interferences, missing data, reported greater-than values, and reported less-than values higher than the MLs are described in Appendix B, “Revised Data Conventions for the 50-POTW Study Analytical Data.” To compare the proposed changes to the traditional editing criteria used for the MP&M proposal, additions to the criteria are highlighted as “(New)” and revisions to existing criteria are highlighted as “(Revised).”

The principal editing criterion of the pass-through analysis used for the MP&M proposal -- using available performance data representing average influent concentrations 10 times the analytical ML. This is also the primary editing criteria for ensuring that promulgated effluent limitations guidelines and standards are based only on the performance of BAT wastewater treatment systems with meaningful influent concentrations of pollutants. This editing criterion ensures that BAT data would demonstrate at least 90 percent removal of toxic pollutants. EPA selected this criterion for the POTW data for similar reasons. However, after reconsidering the design differences between industrial BAT treatment and POTW treatment systems as well as the differences in toxic pollutant influent concentrations, EPA believes that the “10xML” editing criterion is too restrictive for the purpose of analyzing POTW data, especially where effluent values are above the ML.

The majority of discharging POTWs (67 percent) have installed secondary biological treatment systems³ designed to treat conventional pollutants characteristic of domestic sewage (primarily BOD₅ and TSS). Most POTWs with secondary treatment have installed a variation of the activated sludge biological process with typical wastewater hydraulic residence times ranging from 4 to 8 hours for the most prevalent process designs.⁴ Very few secondary POTWs install unit operations specifically designed to remove toxic and non-conventional pollutants.⁵

In contrast, depending on raw waste characteristics, industrial treatment systems are often designed to remove toxic pollutants using a wide variety of in-plant wastewater treatment unit operations with or without end-of-pipe secondary biological treatment systems and sometimes followed by tertiary controls. For example, plants in the MP&M, electroplating, iron and steel, OCPSF, inorganic chemicals, landfills, commercial hazardous waste combustor, centralized waste treatment and other industries may use in-process or end-of-pipe chemical precipitation for metals control, alkaline chlorination for cyanide control, steam or air stripping for volatile organic pollutant control, and activated carbon or biological treatment for control of a wide variety of organic pollutants. For plants in the OCPSF industry with end-of-pipe secondary biological treatment systems, the median and average wastewater hydraulic residence times are 48 and 118 hours, respectively.⁶ Most of the pollutant-specific treatment unit operations listed above are not used to treat POTW wastewater because of the relatively low influent toxic pollutant concentrations. POTW toxic pollutant influent concentrations are often orders of magnitude lower than industrial raw waste concentrations.

Because of these design and toxic pollutant influent concentration differences, the POTW data editing criteria should reflect typical incidental removals of toxic pollutants in secondary biological treatment systems designed and operated to control municipal sewerage. In general, due to

³ The 1996 Clean Water Needs Survey found that of the 13,992 discharging POTWs, 1.3 percent reported less than secondary treatment, 67.1 percent reported secondary treatment, and the remaining 31.6 percent reported better than secondary treatment (www.epa.gov/owm/uc.htm at Appendix C).

⁴ Hydraulic residence times for the conventional and tapered aeration activated sludge processes range from 4 to 8 hours; for the step aeration and contact stabilization processes, from 3 to 6 hours; for the modified and high-rate aeration processes, from 0.5 to 3 hours; and for the extended aeration process, from 18 to 36 hours (1992 WEF Manual of Practice No. 8, page 627, Vol. I).

⁵ Typical POTW unit operations include preliminary treatment (screening and grit removal), primary treatment (sedimentation, sludge collection, and odor control), and secondary treatment (biological treatment with secondary clarification). POTW unit operations associated with advanced or tertiary treatment include nutrient controls (phosphorus and nitrogen [including ammonia] removal processes), multi-media filtration, and activated carbon (1992 WEF Manual of Practice No. 8, pages 389, 447, 517, and 675, Vol. I and pages 895 and 1013, Vol. II).

⁶ Based on 31 OCPSF biological treatment systems with residence times ranging from 4.5 to 1,008 hours (“Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Point source Category,” (EPA 440/1-87/009), October 1987, Vol. II, page VIII-45 and “Supplement to the Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Point source Category,” (EPA 821-R-93-007), May 1993, pages III-20 to 23).

dilution in municipal sewer collection systems, POTW influent concentrations of toxic pollutants are lower than the influent concentrations of industrial treatment systems. In those cases where both industrial and municipal treatment systems reduce the effluent pollutant concentration to the analytical ML, the relative performance – percent removal -- is primarily a function of the influent concentrations. This was the principal reason for initially using the “10xML” influent editing criterion for retaining POTW average performance data – to avoid the bias of calculating artificially low median percent removals (median of POTW average performance). However, this editing criterion, when applied to the 50-POTW Study data, overestimates POTW incidental removals for many toxic pollutants. In the 50-POTW Study data base, there are many cases where POTW average influent concentrations are less than the “10xML” editing criterion and the average effluent data are above the ML. These cases should be included in the calculation of national POTW performance (median of POTW average percent removals) because they accurately reflect the incidental removals of the toxic pollutants in treatment systems primarily designed for the control of conventional pollutants. For example, for many POTWs in the study, average metal pollutant influent concentrations less than “10xML” are paired with average effluent concentrations where each data point is measured above the analytical ML. Because of these pairings, EPA can accurately calculate the incidental removals of toxic pollutants characteristic of POTW designs and the characteristically low POTW toxic pollutant influent concentrations. EPA believes it is reasonable to include these percent removal calculations in its pass-through analysis.

Furthermore, one of the observations and conclusions in the 50-POTW Study was that for many pollutants, “as influent concentrations increased effluent concentrations also increased. This implies that the removal rates for the priority pollutants are relatively constant and a fixed percentage of incremental loadings of these pollutants will be removed by secondary treatment.” Therefore, except for highly biodegradable compounds, for typical POTW secondary biological treatment designs without specific unit operations for toxic pollutant control, one would not necessarily expect the percent removals of toxic pollutants to increase (above incidental removal levels) as influent concentrations increased.

Assessment of Editing Criteria for 50-POTW Performance by Treatment Technology

EPA is also considering incorporating POTW treatment system and BOD₅/TSS performance editing criteria into the methodology for determining POTW performance (percent removal) for toxic and non-conventional pollutants.

A major goal of the 50-POTW study was to obtain toxic priority pollutant data from representative types of secondary treatment facilities that would exist after completion of EPA’s Construction Grants program. The 50 POTWs selected for sampling are representative of biological treatment processes – 35 activated sludge, 8 trickling filter, 4 activated sludge with parallel trickling filter, 1 rotating biological contactor, 1 aerated lagoon, and 1 lagoon system. Eight of these POTWs include post-secondary or tertiary treatment (4 filtration and 4 lagoon systems).

The 50-POTW Study and subsequent assessments of POTW performance (including the assessment for the MP&M proposal) used combined end-of-pipe data for all 50 POTWs. The analyses did not assess potential differences in toxic pollutant reductions among the various types of secondary systems, between secondary and tertiary systems, and among different levels of BOD₅ and TSS control (the principal design basis for POTW treatment systems).

After publication of the 50-POTW Study, EPA promulgated its Secondary Treatment Regulation (40 CFR Part 133) to provide information on the level of effluent quality attainable through the application of secondary or equivalent treatment. Secondary treatment generally refers to activated sludge biological processes and treatment equivalent to secondary treatment refers to trickling filters or waste stabilization ponds. The secondary treatment performance criteria for both BOD₅ and TSS are 30-day and 7-day averages not exceeding 30 mg/l and 45 mg/l, respectively. The BOD₅ and TSS criteria for equivalent secondary treatment for both BOD₅ and TSS are 30-day and 7-day averages not exceeding 45 mg/l and 65 mg/l, respectively. These definitions and treatment levels provide the basis for the technology and BOD₅/TSS performance edits being proposed for use in the final rule.

The revised analyses under consideration include separating the data collected for the 4 parallel activated sludge and trickling filter systems and, for 2 of the tertiary systems, including the secondary activated sludge sampling data. This expands the performance data base to 56 POTW treatment trains – 41 activated sludge, 12 trickling filter, 1 rotating biological contactor, 1 aerated lagoon, and 1 lagoon system. Again, 8 of these treatment trains include secondary or tertiary treatment (4 filtration and 4 lagoon systems). Based on the definitions in 40 CFR Part 133, the POTW treatment trains consist of 47 secondary or equivalent systems, 1 rotating biological contactor, and 8 post-secondary or tertiary systems. The Agency is considering a variety of POTW treatment train and BOD₅/TSS performance editing criteria to determine if these factors significantly affect the incidental removals of toxic and non-conventional pollutants in POTWs. For example, among other alternatives, EPA is considering editing criteria that would retain only those secondary or equivalent treatment trains and the rotating biological contactor treatment train that meet the BOD₅/TSS 7-day average performance criteria. EPA is considering this alternative because it accounts for the fact that only 6 days of data were collected at each POTW.

Revised Editing Criteria for Determining POTW Performance

Based on these concerns, EPA is considering revising the POTW toxic and non-conventional pollutant performance (percent removal) editing criteria. Given the range of analytical MLs⁷ and their influence on calculated percent removals as well as the range of in-place POTW treatment technology, EPA is considering several editing alternatives including:

⁷ For most organic pollutants, the ML is 10 µg/l (several have MLs of 20 and 50 µg/l). For mercury, silver, cadmium, zinc, copper, nickel, lead, and barium, the respective MLs are 0.2, 2, 5, 20, 25, 40, 50, and 200 µg/l.

Alternative A – For POTW treatment trains that meet the 7-day conventional pollutant performance criteria for BOD₅ (45 mg/l or lower) and TSS (45 mg/l or lower) using secondary activated sludge biological treatment or its equivalent:

1. If all effluent values are equal to the ML and the ML is less than or equal to 20 µg/l, retain the pollutant performance (percent removal) if the pollutant influent average is at least ten times the nominal minimum level (10xML).
2. If all effluent values are equal to the ML and the ML is greater than 20 mg/l, retain the pollutant performance (percent removal) if the pollutant influent average is at least ten times one-half the nominal minimum level [10 x (0.5xML) or 5 x ML].
3. If the effluent average is greater than the ML, retain the pollutant performance (percent removal) regardless of the pollutant influent average.
4. The national POTW/pollutant percent removal is the median of the retained values from 1, 2, and 3 above.

Alternative B -- The same as Alternative A for items A1, A2, and A4 with the following modification to item A3: If the effluent average is greater than the ML, retain the pollutant performance (percent removal) if the pollutant influent average is at least two times the nominal minimum level (2xML). Based on the analyses conducted to date, this is the Agency's preferred alternative.

Alternative C – Retain all toxic pollutant data for POTW treatment trains that meet the 7-day conventional pollutant performance criteria for BOD₅ (45 mg/l or lower) and TSS (45 mg/l or lower) using secondary activated sludge biological treatment or its equivalent.

Alternative D -- The same as Alternative B with the following modifications: (a) Retain POTW treatment trains with secondary biological treatment (as designated by treatment flag "S"), only if both the effluent BOD₅ and TSS average concentrations are less than or equal to 45 mg/l. (b) Retain POTW treatment trains with equivalent to secondary biological treatment (as designated by treatment flag "E"), only if both the effluent BOD₅ and TSS average concentrations are less than or equal to 65 mg/l.

Alternative E -- The same as Alternative D with the following modification: substitute 0.5XML for all data points set equal to the analytical ML.

Table A-1 lists the national POTW percent removals for several pollutants, determined by using the traditional methodology for the proposal (Column 2), Alternative A (Column 3), Alternative B (Column 4), Alternative C (Column 5), Alternative D (Column 6), and Alternative E

(Column 7). For the proposal, EPA has used the traditional methodology to estimate POTW percent removals, and, therefore, whether these pollutants “pass through” for purposes of selecting pollutants for regulation by PSES and PSNS. EPA solicits comments on its pass-through methodology, including the revised editing criteria discussed above as well as for other alternatives.

Assessment of the Use of Analytical Minimum Levels

Since some commenters have concerns that EPA’s use of the ML for reported effluent data of <ML underestimates actual percent removal, EPA tried to determine the extent of this situation and possible effects on estimating POTW percent removals for the pass through analysis. The assessment below indicates that the proportion of POTW not-detected effluent toxic pollutant data varies from pollutant to pollutant and from POTW to POTW.

To help characterize the effect of substituting the analytical ML for not-detected data, the Agency assigned each POTW/pollutant data set to one of three groups based on the proportion of not-detected effluent values, as follows:

1. All ND -- when all of the effluent data points were not detected or assigned the ML value for the pollutant,
2. All NC (non-censored) – when all of the effluent data points were measured concentrations above the ML for the pollutant, and
3. Mix (NC & ND) – when the effluent data points were a mixture of not-detect and measured values.

For those cases where all of the effluent data were non-censored, the calculated percent removal reflects POTW incidental removals with the most accuracy. For those cases where all the effluent data were not detected, the calculated percent removal reflects POTW incidental removals with the least accuracy. In those cases where the effluent data is a mixture of not detected and non-censored data, the calculated percent removals are probably more accurate than “All ND” but less accurate than “All NC”. Table A-2 provides pollutant-by-pollutant tabulations for the number of POTWs retained by the Alternative D data conventions with counts of the POTWs effluent data sets that fall into each category.

For the 21 metal pollutants retained by the Alternative D data conventions, about 97 percent of the 347 POTW/metal pollutant effluent data sets in the table are comprised of all NC (66 percent) and a mixture of NC & ND (31 percent) values. For ammonia and cyanide, 100 percent of the 65 data sets are comprised of all NC (99.5 percent) and a mixture of NC & ND (0.5 percent) values.

The 28 organic pollutants retained by the Alternative D data conventions were divided into low, medium, and high Henry's Law Constant groups. For the six organics with low Henry's Law Constants (10^{-3} to 10^{-8}), about 81 percent of the 38 POTW/organic pollutant effluent data sets in the table are comprised of all NC (18 percent) and a mixture of NC & ND (63 percent) values. For the nine organics with medium Henry's Law Constants (10^{-1} to 10^{-3}), about 83 percent of the 36 POTW/organic pollutant effluent data sets in the table are comprised of all NC (25 percent) and a mixture of NC & ND (58 percent) values. For the 13 organics with high Henry's Law Constants (2×10^2 to 10^{-1}), about 83 percent of the 73 POTW/organic pollutant effluent data sets in the table are comprised of all NC (19 percent) and a mixture of NC & ND (64 percent) values.

The Agency concludes that POTW performance for metals, ammonia, cyanide, and organic pollutants is not significantly affected by the bias of effluent data being less than the MLs.

Table A-1 – Comparison of 50-POTW Study Removal Estimation Alternatives (Median Percent Removals)

Pollutant Parameter	Traditional Method %	Alternative A %	Alternative B %	Alternative C %	Alternative D %	Alternative E %	Analytical ML µg/l
Ammonia	39	40	40	40	39	39	10
Cyanide	70	65	66	60	65	65	20
Antimony	67	47	57	10	57	57	20
Cadmium	90	86	89	37	89	89	5
Chromium	80	76	77	76	76	77	10
Copper	84	80	80	80	79	80	25
Iron	82	82	82	82	80	82	100
Lead	77	48	57	55	57	69	50
Manganese	36	24	24	24	23	23	15
Mercury	90	63	63	60	61	73	0.2
Nickel	51	28	29	32	29	29	40
Silver	88	67	69	69	67	73	2
Tin	43	20	41	39	41	47	30
Zinc	79	77	77	77	76	76	20
Naphthalene	95	95	95	39	95	97	10
Phenol	95	95	96	70	96	97	10

Table A-2 - Number of POTWs Retained by Alternative D Data Conventions

Analyte	CAS No.	Total Number POTWs	Effluent “All NC”	Effluent Mix (NC and ND)	Effluent “All ND”
Class=Metals, Tech Group=E or S					
Aluminum	7429905	31	11	16	4
Antimony	7440360	1	1	0	0
Boron	7440428	6	4	2	0
Cadmium	7440439	6	2	4	0
Calcium	7440702	36	35	1	0
Chromium	7440473	34	23	11	0
Cobalt	7440484	1	0	1	0
Copper	7440508	34	13	17	4
Iron	7439896	43	34	9	0
Lead	7439921	7	2	4	1
Magnesium	7439954	22	22	0	0
Manganese	7439965	40	38	2	0
Mercury	7439976	15	4	11	0
Molybdenum	7439987	2	1	1	0
Nickel	7440020	14	9	5	0
Silver	7440224	17	5	12	0
Sodium	7440235	21	21	0	0
Tin	7440315	3	1	2	0
Titanium	7440326	10	1	9	0
Vanadium	7440622	2	2	0	0
Yttrium	7440655	2	0	2	0
Total		73	14	47	12

Table A-2 (Continued)

7.0 - Selection of Pollutant Parameters

Analyte	CAS No.	Total Number POTWs	Effluent “All NC”	Effluent Mix (NC and ND)	Effluent “All ND”
Class=Nonconventional, Tech Group=E or S					
Ammonia as N	7664417	35	35	0	0
Total Cyanide	57125	30	27	3	0
Total		65	62	3	0
Class=Organics_LOW, Tech Group=E or S					
Bis(2-ethylhexyl)phthalate	117817	25	6	19	0
Butyl benzyl phthalate	85687	1	0	0	1
Di-n-butyl phthalate	84742	2	0	2	0
Di-n-octyl phthalate	117840	2	0	2	0
Fluoranthene	206440	1	0	1	0
Phenol	108952	7	1	0	6
Total		38	7	24	7
Class=Organics_MED, Tech Group=E or S					
Acenaphthene	83329	2	0	1	1
Anthracene	120127	2	0	1	1
Methylene chloride	75092	22	7	15	0
Naphthalene	91203	1	0	0	1
Phenanthrene	85018	2	0	1	1
1,2-Dichlorobenzene	95501	2	0	1	1
1,2-Dichloroethane	107062	2	2	0	0
1,2-Dichloropropane	78875	1	0	0	1
1,2,4-Trichlorobenzene	120821	2	0	2	0
Total		36	9	21	6

Table A-2 (Continued)

7.0 - Selection of Pollutant Parameters

Analyte	CAS No.	Total Number POTWs	Effluent “All NC”	Effluent Mix (NC and ND)	Effluent “All ND”
Class=Organics_HIGH, Tech Group=E or S					
Benzene	71432	5	0	2	3
Chlorobenzene	108907	1	0	0	1
Chloroform	67663	5	2	3	0
Chloromethane	74873	2	0	2	0
Dichlorodifluoromethane	75718	1	1	0	0
Ethylbenzene	100414	5	0	5	0
Tetrachloroethene	127184	15	4	9	2
Tetrachloromethane	56235	1	1	0	0
Toluene	108883	11	0	9	2
Trans-1,2-Dichloroethene	156605	2	0	2	0
Trichlorethene	79016	10	4	4	2
Vinyl chloride	75014	1	0	1	0
1,1,1,-Trichloroethane	71556	14	2	10	2
Total		347	229	109	9

Source: U.S. EPA, 50-POTW Study, 1982.

Tech Group E = POTWs that achieve effluent BOD₅/TSS concentrations less than or equal to 65 mg/l.Tech Group S = POTWs that achieve effluent BOD₅/TSS concentrations less than or equal to 45 mg/l.Class Organics_LOW = Organics with Henry’s Law Constant between 10⁻⁸ and 10⁻³.Class Organics_MED = Organics with Henry’s Law Constant between 10⁻³ and 10⁻¹.Class Organics_HIGH = Organics with Henry’s Law Constant between 10⁻¹ and 1x10².

Appendix B

Revised Data Conventions for the “50-POTW Study” Analytical Data

1. (New) Applied an alpha-numeric naming convention to identify parallel treatment trains within a POTW. The naming convention is composed of the POTW’s number and a suffix. For example, POTW 10 has two parallel treatment trains. The applied convention designates these trains as 10A and 10B. Records associated with treatment train “A” in POTW 10 all carry the designation 10A. If a POTW has only one treatment train, then, with one exception, all records for the POTW are identified by the POTW number. No suffix is applied. In the case of POTW 56, a sampling point is designated after primary clarification (56A) and after tertiary filtration (56B). Samples were not collected after the secondary activated sludge treatment unit. The traditional data conventions – used for the MP&M proposal -- averaged all of the respective influent and effluent values for parallel treatment systems.
2. (New) Added treatment technology codes and technology flags. Treatment Technology codes include “AS” for activated sludge, “TF” for trickling filter, “RBC” for rotating biological contactor, lagoon, and primary clarifier. Some POTWs use a combination of treatments such as AS + tertiary oxidation ponds. When treatment technologies are used in combination, the combination is identified. Technology flags are: “P” for primary treatment; “S” for secondary biological treatment; “E” for equivalent to secondary biological treatment; and “T” for secondary biological or equivalent treatment systems with tertiary treatment unit operations.
3. This placeholder ensures consistency between the computer output headings and these data conventions. (The numbered statements correspond to preliminary drafts of the revised data conventions. Some data conventions contained in earlier drafts were mistaken or misplaced in sequence and EPA removed these conventions from subsequent drafts. However, EPA retained the assigned number sequence because of reference to these numbers in the computer listings. Thus, this number is effectively blank.)
4. Converted the units of measure for each pollutant to a common metric.
5. (Revised) Deleted individual data points for a pollutant if supporting records indicated that one of the following conditions was met (corresponding to key codes 4, 5, 6, and 8 described at the end of this appendix):

- a. Analytical interference prevented the determination of the presence or quantification of the pollutant (key code = 4),
- b. Analytical interference was indicated, but the pollutant concentration was not recorded above the concentration reported (key code = 5),
- c. No chemical analysis was conducted or the result of the chemical analysis was not reported (key code = 6), and
- d. The pollutant was qualitatively present but not quantified or confirmed (key code = 8).
- e. (Revised) Deleted the record results from a “right censored” qualitative method. These records are identified as “greater-than (>) X” where “X” is a method specific value. This indicator signifies that the recorded measure is the lower bound of the amount of the pollutant in the sample. The traditional data conventions – used for the MP&M proposal -- reported “>values” as the value. (If calculations are based on influent “>values,” then the percent removals would be lower than they should be. If calculations are based on effluent “>values,” then the percent removals would be higher than they should be.)

The revised data conventions delete pollutant concentration data points on an individual basis, not in pairs. For example, if the influent data point meets one of the previously identified conditions, it is deleted. Its paired effluent data point is not deleted unless it too meets one of the conditions. The traditional data conventions deleted data in daily pairs.

- 6. Incorporated the standardized analytical “minimum level” (ML) values for each record. These values were assigned based on a determination of the analytical method employed and the precision and accuracy of the 1978 to 1980 analytical methods used to measure the pollutant.
- 7. (Revised) Deleted records reported as “< values” that are greater than the ML. This may occur when samples are diluted to reduce analytical matrix interference. If a pollutant is not detected in the diluted sample, the resulting ML is multiplied by the dilution factor. (For data reported as “< values,” this rule initially set the value to the ML for calculation purposes without considering if the value is greater than the ML. For influent value substitutions, the traditional editing rule decreases calculated performance. For effluent value substitutions, it increases calculated performance.)

8. Set equal to the pollutant analytical ML, any remaining pollutant values reported as non-detect (key codes 1, 3, 1nd 7):
 - a. Less than the concentration listed (key code = 1),
 - b. Detected, but not quantified at lower than the concentration listed (key code = 3), and
 - c. “Not-detected” (key code = 7),
9. For detected or non-censored (NC) values reported as less than the ML, set the value equal to the ML and report the value as a non-detect.
10. (New) If the pollutant ML is GREATER THAN 20, substituted $0.5 \times \text{ML}$ for influent and effluent samples if all effluent values are equal to the ML and the value was a non-detect. The following pollutants are excluded from this convention: BOD₅, COD, O&G, TDS, TOC, Total Solids, and TSS.
11. Retain pollutant data for a POTW if there are at least three (3) influent concentration values reported and at least one of the reported influent values is measured above the ML for the pollutant.
12. This placeholder ensures consistency between the computer output headings and these data conventions. (The numbered statements correspond to preliminary drafts of the revised data conventions. Some data conventions contained in earlier drafts were mistaken or misplaced in sequence and EPA removed these conventions from subsequent drafts. However, EPA retained the assigned number sequence because of reference to these numbers in the computer listings. Thus, this number is effectively blank.)
13. (New) Retain POTW treatment trains with secondary biological treatment or equivalent (as designated by treatment flags “S” or “E”, only if both the effluent BOD₅ and TSS average concentrations are less than or equal to 45 mg/l.
14. (Revised) Retain non-negative percent removals that are greater than zero for a given pollutant where the percent removal = $(100)(\text{ave influent} - \text{ave effluent})/\text{ave influent}$. The traditional data conventions retained zero percent removals. (The medians of these intermediate values are referred to as Alternative C.)
15. Identify three (overlapping) subsets of POTWs based on the average influent concentration:

- a.
 - (i.) If all effluent values are equal to the ML and the ML is greater than 20 ppb, retain the pollutant performance (percent removal) if the pollutant influent average is at least ten times one-half the nominal minimum level [$10 \times (0.5 \times \text{ML}) = 5 \times \text{ML}$].
 - (ii) If all effluent values are equal to the ML and the ML is less than or equal to 20 ppb, retain the pollutant performance (percent removal) if the pollutant influent average is at least ten times the nominal minimum level ($10 \times \text{ML}$).
 - b. If the effluent average is greater than the ML, retain the pollutant performance (percent removal) regardless of the pollutant influent average.
16. The national POTW/pollutant percent removal is the median of the retained values from 15A and 15B above. (This is referred to as Alternative A.)
 17. Modify 15B: If the effluent average is greater than the ML, retain the pollutant performance (percent removal) if the pollutant influent average is at least two times the nominal minimum level ($2 \times \text{ML}$).
 18. Modify 16: The national POTW/pollutant percent removal is the median of the retained values from 15A and 17 above. (This is referred to as Alternative B.)
 19. Modify 13: (a) Retain POTW treatment trains with secondary biological treatment (as designated by treatment flag “S”), only if both the effluent BOD_5 and TSS average concentrations are less than or equal to 45 mg/l. (b) Retain POTW treatment trains with equivalent to secondary biological treatment (as designated by treatment flag “E”), only if both the effluent BOD_5 and TSS average concentrations are less than or equal to 65 mg/l. (c) The national POTW/pollutant percent removal is the median of the retained values from 15A and 17 above. (This is referred to as Alternative D.)
 20. Modify 19: Substitute $0.5 \times \text{ML}$ for all data points set equal to the analytical ML. (This is referred to as Alternative E.)

Description of the Key Codes (See pages 29 & 30, 50-POTW Study) used to qualify analytical results in the 50-POTW Data Set.

<u>CODE</u>	<u>CONCENTRATION</u>	<u>MEANING OF CODE</u>
0	any	detected at this concentration
1	any	less than this concentration
2	any	detected at greater than (>) this concentration
3	any	detected, but not quantified at lower than this concentration
4	0	analytical interference prevented determination of the presence or prevented quantification of the analyte
4	any value >0	analytical interference was present, but concentration was estimated as this concentration
5	any	analytical interference was present, but the analyte was not detected above this concentration
6	0	no analysis was run or reported
7	0 or blank	reported as "not detected"
8	0	analyte was detected, but could not be quantified
8	any value >0	a pesticide was detected by GC-ECD at this concentration, but GC-MS did not confirm the presence of the analyte